NMS SS7 Configuration Manual

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NMS COMMUNICATIONS

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1 Introduction

The *NMS SS7 Configuration Manual* explains how to configure NMS SS7 and bring the links into service. This manual discusses the following configurations:

- TDM channels
- MTP 2 and 3 layers
- Optional ISUP, SCCP, TCAP, and TUP layers

2 Configuration overview

Sample SS7 configurations

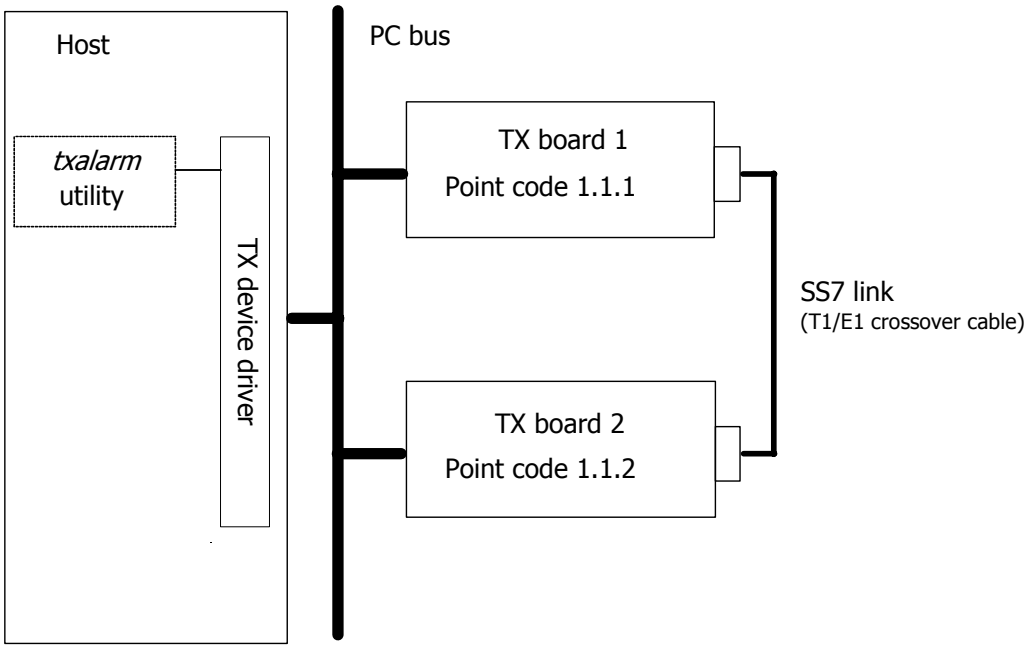
Depending on the physical hardware configuration of your TX boards, the SS7 link interface between the boards can be one of the following:

- A single timeslot on one of the T1/E1 trunks. TX 3220/C boards require a dual-T1 or dual-E1 daughterboard or a rear transition board. TX 4000/C boards include an on-board quad T1/E1 interface.
- All of the timeslots on a T1/E1 trunk. High speed links (HSL) meet the ANSI T1.111-1996 and Q.703/Annex A standards. Each HSL occupies a full (unchannelized) T1/E1 line and transfers data at the rate of 2.0 (1.544) Mbps.
- A single timeslot on the H.100/H.110 bus.
- A V.35 serial link. The V.35 connection option is provided only on TX 3220/C boards and requires a V.35 serial daughterboard or a rear transition board.

NMS SS7 provides the following sample configurations that you can modify for your specifications:

Configuration type	Location
ANSI standalone	*\nms\tx\config\standalone\ansi* for a Windows system */opt/nmstx/etc/standalone/ansi* for a UNIX system
ANSI redundant	*\nms\tx\config\redundant\ansi* for a Windows system */opt/nmstx/etc/redundant/ansi* for a UNIX system
ITU standalone	*\nms\tx\config\standalone\itu* for a Windows system */opt/nmstx/etc/standalone/itu* for a UNIX system
ITU redundant	*\nms\tx\config\redundant\itu* for a Windows system */opt/nmstx/etc/redundant/itu* for a UNIX system

The following illustration shows the ANSI standalone sample configuration:



Configuration summary

Before starting the NMS SS7 configuration, complete the following installations:

Step	Description	For details, refer to...
1	Install the TX board	The appropriate board installation manual.
2	Install the Natural Access development environment under Windows or UNIX.	The *Natural Access Installation* booklet and the *Natural Access Developer's Reference Manual*.
3	Install the NMS SS7 software	The *NMS SS7 Installation* booklet.

Then follow these steps to configure NMS SS7 and bring the links into service:

Step	Description	For details, refer to...
1	To use T1/E1 trunks or H.100/H.110 bus channels as the physical SS7 links, configure the streams and timeslots to carry the SS7 links.	*TDM configuration overview (TX 4000/C)* on page 13 *TDM configuration overview (TX 3220/C)* on page 41
2	Configure the MTP layers.	*MTP configuration overview* on page 47
3	Configure the optional layers.	*ISUP configuration overview* on page 85 *SCCP configuration overview* on page 97 *TCAP configuration overview* on page 119 *TUP configuration overview* on page 125
4	Start the *txalarm* utility on the host to monitor the status of the links.	*Starting txalarm* on page 135
5	Download the appropriate configurations to the TX boards.	*Downloading to the boards* on page 135
6	Check the *txalarm* messages to see that the links come into service on the boards.	*Monitoring link status* on page 143
7	Troubleshoot any problems indicated in the *txalarm* messages.	*Troubleshooting link problems* on page 144

3 Configuring TDM (TX 4000/C)

TDM configuration overview (TX 4000/C)

Before T1/E1 trunks or H.100/H.110 bus channels (also known as TDM channels) can be used for physical SS7 links, you must download a TDM configuration to the TX board. To configure a TX 4000/C board, create a TDM configuration file (*txcfg**n.***txt) that defines TDM clocking control, configures all T1/E1 trunks, and defines all dedicated data channels. Each TX board in a system requires a separate TDM configuration file.

The NMS TDM configuration utility, *txconfig,* runs as part of the initial board configuration with *ss7load. txconfig* reads the TDM configuration file and downloads the specified configuration to the TX 4000/C board.

This topic presents:

- Sample TDM configuration files
- Common configuration changes

Sample TDM configuration files

NMS SS7 provides the following sample TDM configuration files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. The sample TDM configuration files present the most common type of TX board use.

Files	Description
txcfg1.txt	Configures the first TX 4000/C board in a chassis with four T1 trunks. This configuration file specifies that the clock signal recovered from the first trunk connection (trunk 1) is used as the clock source for the TX board. No H.100/H.110 clock signals are driven by this configuration.
txcfg2.txt	For two TX 4000/C boards in a chassis. This configuration file configures the second board with the T1 trunks set as loop master. This board is configured as the master clock source (using the board's internal oscillator). No H.100/H.110 clock signals are driven by this configuration.

For the location of the sample configuration files, see *Sample SS7 configurations* on page 9.

The following example shows a *txcfg.txt* for a TX 4000 board operating in T1 mode:

```
     #         T1 Example
#         Timing Configurations:
#
# use clock recovered from trunk 1 as board's clock and drive H.100/H.110 A clocks
clock net=1 a
# use clock recovered from trunk 2 as network reference clock (drive NR1 signal)
netref 2 nr1
#
# Configure all 4 trunks as T1 mode (not loop master)
#-------------------------------------------------------------------------------
#     Trunk     Framing   Encoding   Buildout   Loop Master
t1cfg 1         esf       b8zs       0          false
t1cfg 2         esf       b8zs       0          false
t1cfg 3         esf       b8zs       0          false
t1cfg 4         esf       b8zs       0          false
# define ports that SS7 links will connect through
#-------------------------------------------------------------------------------
#    PortNum    L|H|E|T|J   Trunk   Channel     Speed
port 1          t1          1       0
port 2          t1          2       23
```

The following example shows a *txcfg.txt* for a TX 4000 board operating in E1 mode:

```
     #         E1 Example
#         Timing Configurations:
#
# use clock recovered from trunk 1 as board's clock and drive H.100/H.110 A clocks
clock net=1 a
# use clock recovered from trunk 2 as network reference clock (drive NR1 signal)
netref 2 nr1
#
# Configure all 4 trunks as E1 mode (not loop master)
#-------------------------------------------------------------------------------
#     Trunk     Framing   Encoding   Loop Master
e1cfg 1         ccs       hdb3       false
e1cfg 2         ccs       hdb3       false
e1cfg 3         ccs       hdb3       false
e1cfg 4         ccs       hdb3       false
# define ports that SS7 links will connect through
#-------------------------------------------------------------------------------
#    PortNum    L|H|E|T|J   Trunk   Channel     Speed
port 1          e1          1       1
port 2          e1          2       31
```

Common configuration changes

The following list provides some common TDM configuration changes required for different hardware configurations.

- The sample TDM configuration files assume T1 trunks for ANSI configurations and E1 trunks for ITU configurations. If you use a different trunk type than the examples use, change the T1/E1 parameter lines to reflect the proper parameters. For T1 port definitions, the channel number is a zero-based value identifying the timeslot to access. For T1, channels 0 through 23 are available, providing access to all 24 timeslots of a T1 trunk. For E1, channels 1 through 31 are available, providing access to the 31 E1 timeslots beyond timeslot zero. Timeslot zero is used solely for framing on E1 trunks and cannot be used to transport data such as SS7.
- To configure a high speed link (HSL), replace the channel number with an asterisk (*).

- The sample configuration files contain commented out sections that define other types of TDM connections, such as E1 for files that default to T1 or H.100/H.110. To change from T1 to E1 or from T1 to H.100 for example, comment out the original configuration lines and paste a copy of the desired example lines, removing the comment character to activate the pasted lines.
- Modify clocking control based on the specific environment. The sample configuration file for board 1 (*txcfg1.txt*) assumes the board receives the clock signal from the first T1 or E1 trunk, implying that the first trunk is connected to another trunk that is acting as the loop master. The sample configuration file for board 2 (*txcfg2.txt*) configures that board to act as the loop master for all its T1 or E1 trunks. If this is not the configuration you want to use, modify the clock statement, or the Loop Master field, or both.

For details on configuring TDM, see the following topics:

- *H.100 and H.110 bus clocking overview* on page 16
- *Configuring clocking (TX 4000/C)* on page 24
- *Configuring T1/E1 trunks (TX 4000/C)* on page 27
- *Configuring ports (TX 4000/C)* on page 34

H.100 and H.110 bus clocking overview

If the boards in a system are connected to each other on the CT bus, you must set up a bus clock to synchronize communications between the boards connected to the bus. To provide redundant and fault-tolerant clocking on the bus, configure alternative (fallback) clock sources to provide the clock signal if the primary source fails.

This topic presents:

- Clock masters and clock slaves
- Timing references
- Fallback timing references
- Clock signal summary
- Board-level clock fallback
- NETREF (NETREF1) and NETREF2

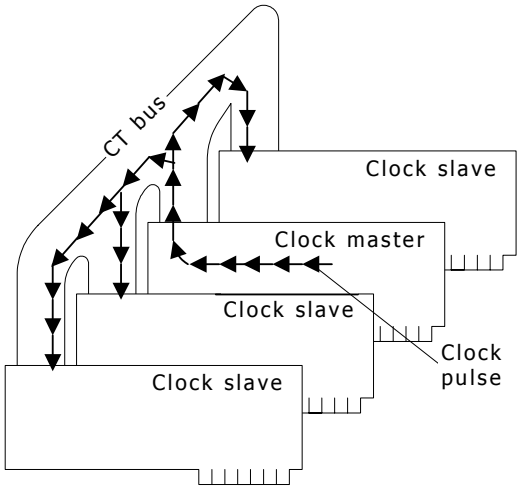
These topics present H.100/H.110 clocking as described in the *ECTF H.110 Hardware Compatibility Specification: CT Bus R1.0.*

Note: Board clocking procedures are not transparent to the application. In addition to configuring clocking, the application must monitor clocking and take appropriate action when required.

Clock masters and clock slaves

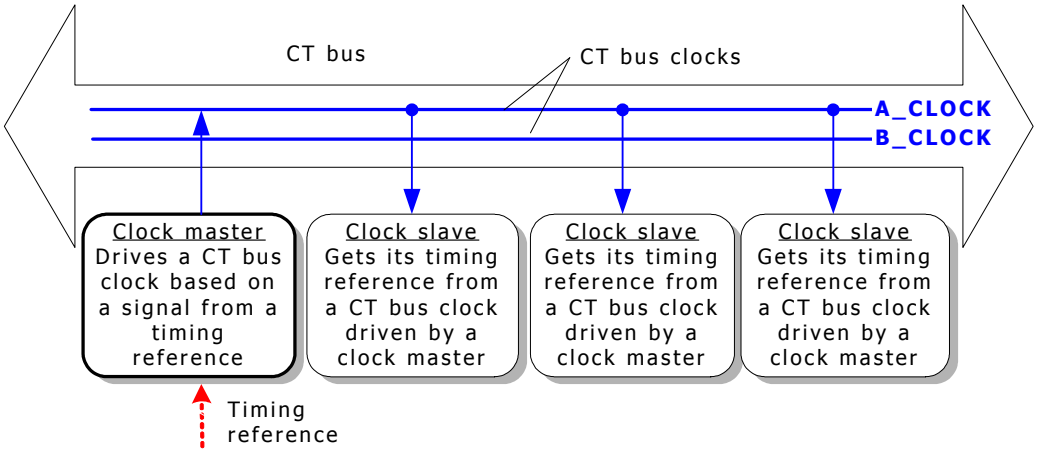
To synchronize data transfer from board to board across the H.100 bus or H.110 bus, boards on the bus must be phase-locked to a high-quality 8 MHz clock and 8 kHz frame pulse. These signals together compose a CT bus clock.

One board on the bus generates (drives) the clock. This board is called the clock master. All other boards use this clock as a timing reference by which they synchronize their own internal clocks. These boards are called clock slaves. The following illustration shows the clock master and clock slaves:



Two CT bus clocks can run simultaneously on the bus. They are called A_CLOCK and B_CLOCK. The clock master can drive either one. When you set up CT bus clocking, choose one of these clocks for your master and slaves. The other one is a redundant signal that can be used by a secondary clock master (described in *Secondary clock master fallback* on page 22).

In the following illustration, the system is set up to use A_CLOCK:

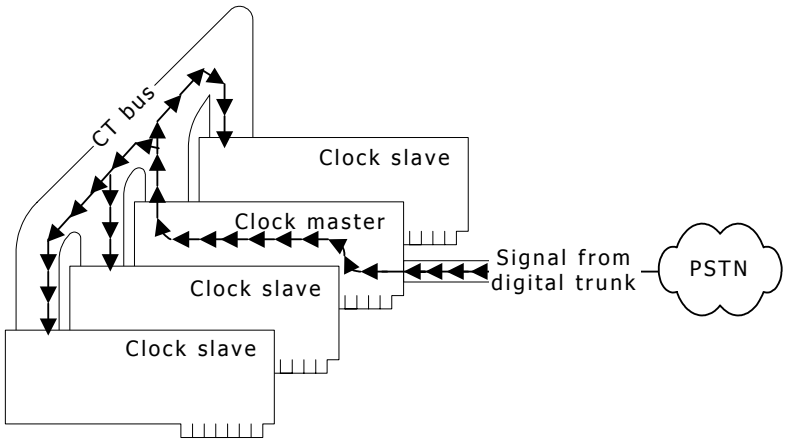

CT bus
CT bus clocks
A_CLOCK
B_CLOCK
Clock master
Drives a CT bus clock based on a signal from a timing reference
Clock slave
Gets its timing reference from a CT bus clock driven by a clock master
Clock slave
Gets its timing reference from a CT bus clock driven by a clock master
Clock slave
Gets its timing reference from a CT bus clock driven by a clock master
Timing reference

Timing references

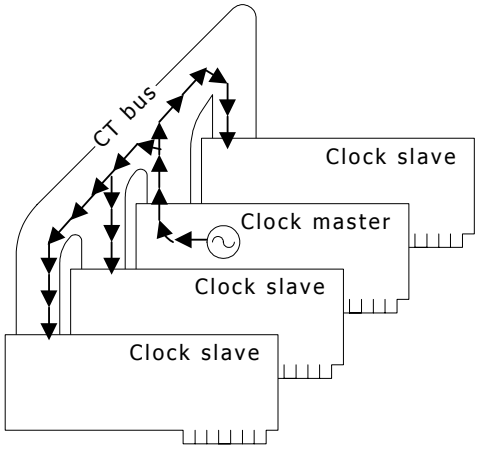
To drive its CT bus clock, a clock master takes a reference signal, extracts the frequency information, defines a phase reference at the extracted frequency, and broadcasts this information as A_CLOCK or B_CLOCK. This reference signal is called a timing reference. When you set up a clock master, you specify what source the board uses as its timing reference.

The timing reference signal originates in one of three places:

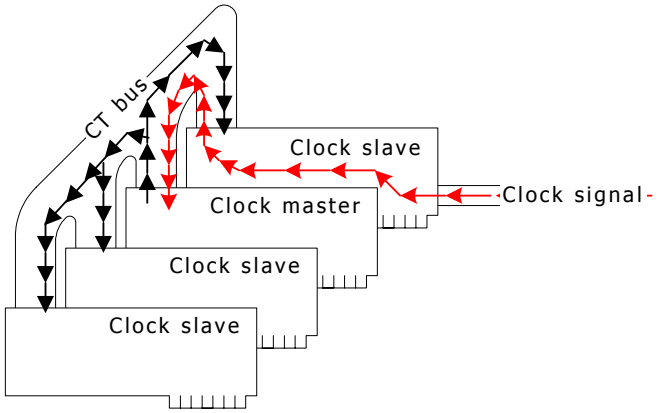
- It can originate within the public network and enter the system through a digital trunk. This is called a NETWORK timing reference as shown in the following illustration:



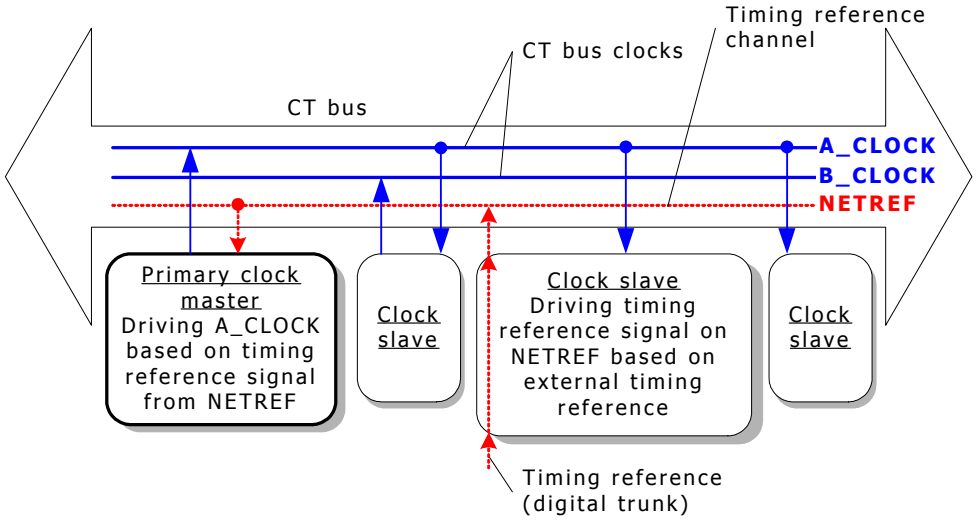
- In a system with no digital telephone network interfaces, an on-board oscillator can be used as the timing reference to drive the clock signals. This is called an OSC timing reference and is shown in the following illustration. Use OSC only if there is no external clock source available.



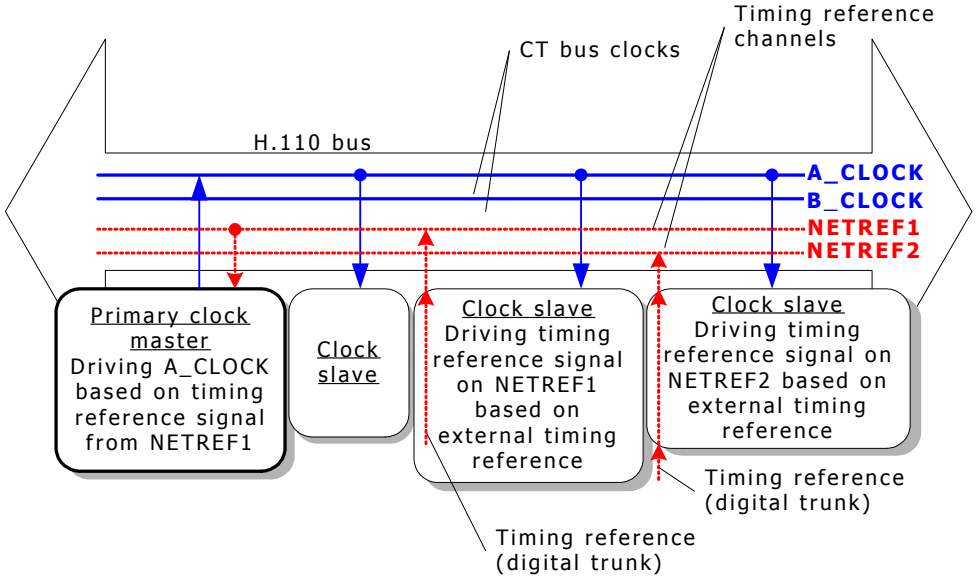
- The timing reference used by a clock master to drive the CT bus clock can also originate from an oscillator or trunk connected to another device in the system. In this case, the timing reference signal is carried over the CT bus to the clock master, which derives the clock signal and drives the clock for the slaves. The following illustration shows a timing reference from another device:



The channel over which the timing reference signal is carried to the clock master is called NETREF, as shown in the following illustration:


Timing reference channel
CT bus clocks
CT bus
A_CLOCK
B_CLOCK
NETREF
Primary clock master Driving A_CLOCK based on timing reference signal from NETREF
Clock slave
Clock slave Driving timing reference signal on NETREF based on external timing reference
Clock slave
Timing reference (digital trunk)

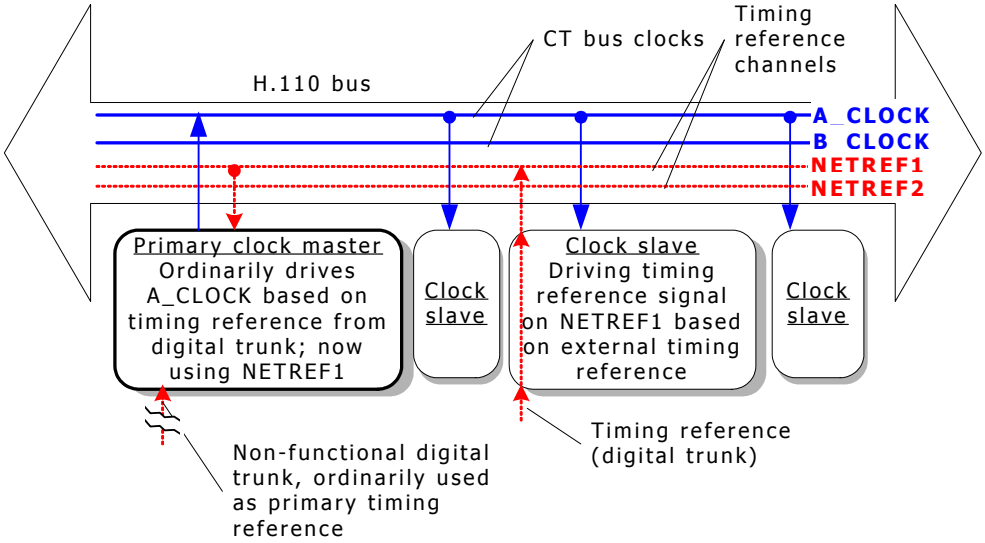
On the H.110 bus, a second timing reference signal can be carried on a fourth channel, called NETREF2 as shown in the following illustration. NETREF is referred to as NETREF1 in this case.


Timing reference channels
CT bus clocks
H.110 bus
A_CLOCK
B_CLOCK
NETREF1
NETREF2
Primary clock master Driving A_CLOCK based on timing reference signal from NETREF1
Clock slave
Clock slave Driving timing reference signal on NETREF1 based on external timing reference
Clock slave Driving timing reference signal on NETREF2 based on external timing reference
Timing reference (digital trunk)
Timing reference (digital trunk)

Fallback timing references

Boards can optionally be assigned a backup (fallback) timing reference that it can use if its primary timing reference fails. For a clock master, the source for the fallback timing reference must be a different source than the one currently used by the clock master for its primary timing reference.

For example, if a clock master's primary timing reference source is a NETWORK signal from one of its trunks, the fallback timing reference source can be a NETWORK signal from another one of its trunks, or a signal from NETREF1, NETREF2 (if H.110), or OSC. In the following illustration, the fallback timing reference source is NETREF1.



The ability of a board to automatically switch to its fallback timing reference if its primary timing reference fails is called clock fallback. This feature can be enabled or disabled.

Clock signal summary

The following table summarizes the reference clocks that a clock master can drive:

Clock	Details
A_CLOCK	The set of primary bit clocks (CT8A) and framing signals (CTFrameA). The CT8A signal is an 8 MHz clocking reference for transferring data over the CT bus. The CTFrameA provides a low going pulse signal every 1024 (8 MHz) clock cycles.
B_CLOCK	The set of secondary bit clocks (CT8B) and framing signals (CTFrameB). The CT8B signal is an 8 MHz clocking reference for transferring data over the CT bus. The CTFrameB provides a low going pulse signal every 1024 (8 MHz) clock cycles.

The following table summarizes the timing references that a clock master can use:

Timing reference	Details
NETWORK	The timing signal from a digital trunk attached to the clock master board. Within the digital trunk interface, an 8 kHz reference is derived from the frequency of the incoming signal. The clock master is frequency-locked to this 8 kHz reference so that the long-term timing of the system matches that of the public telephone network. **Note:** No timing signal is available from an analog trunk.
NETREF/NETREF1	The CTNETREF_1 signal. This signal can be 8 kHz, 1.544 MHz, or 8 MHz. NMS recommends using only 8 kHz signals for most boards.
NETREF2	(H.110 only) The CTNETREF_2 signal. This signal can be 8 kHz, 1.544 MHz, or 8 MHz. NMS recommends using only 8 kHz signals for most boards.
OSC	Clock signal derived from an oscillator on the clock master board. **Note:** Use this timing reference source only if no network timing references are available.

Board-level clock fallback

The TX 4000/C board can be configured to perform in any one of the following fallback roles:

- Primary clock master
- Secondary clock master
- Clock slave

The clock fallback role a TX board takes is based on how the main clocking parameters are configured. If no fallback clock is configured, the TX board does not participate in any fallback behavior. For more information, see *Configuring clocking (TX 4000/C)* on page 24.

Primary clock master fallback

Clock fallback for a primary clock master works as follows:

1. The primary clock master synchronizes with its primary network timing reference and drives the primary CT bus clock.
2. If the primary network reference fails, the clock master continues to drive the primary CT bus clock, but switches to the fallback network timing reference as its synchronization source.
3. If the secondary timing reference fails, the primary clock master stops driving the primary CT bus clock, and falls back to the secondary CT bus clock, which is now driven by the secondary clock master off its fallback timing reference.
4. If the secondary CT bus clock fails, the board falls back to its internal oscillator and continues to monitor the state of the secondary CT bus clock.
5. If the secondary CT bus clock is reestablished, the board synchronizes again with the secondary CT bus clock.

Secondary clock master fallback

You can set up a second device to be used as a backup or a secondary clock master if the primary clock master stops driving its CT bus clock (because both of its timing references failed, or it was hot-swapped out).

Clock fallback for a secondary clock master works as follows:

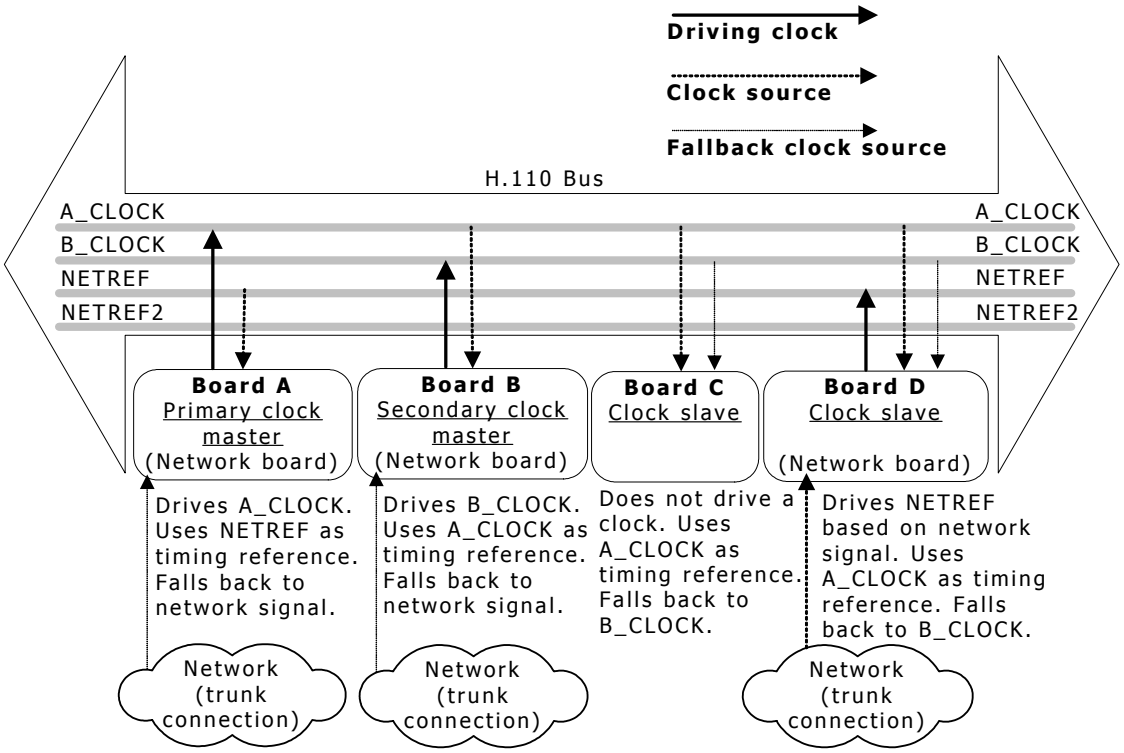
1. As long as the primary clock master is driving its CT bus clock, the secondary clock master acts as a slave to the primary clock master. However, the secondary master also drives the CT bus clock not driven by the primary master (for example, B_CLOCK if the primary master is driving A_CLOCK).
2. If the primary clock master stops driving its CT bus clock, all slaves (including the secondary clock master) lose their primary timing reference.
3. This failure triggers the secondary master to fall back to its fallback timing reference and continue to drive the secondary CT bus clock from the fallback reference.
4. This failure also triggers other slaves to fall back to the CT bus clock driven by the secondary clock master.
5. The secondary master and slaves do not switch back to the primary timing reference automatically if the primary reference is reestablished. Software intervention is required prior to any further clock changes.
6. If the board formerly used as the primary clock master is still active but is not receiving a primary or fallback timing reference, the board becomes a slave to the clock driven by the secondary master.
7. If the secondary clock master's fallback clock reference fails, it switches to an internal oscillator and continues to drive the secondary CT bus clock.
8. Upon recovery of the fallback clock reference, the secondary clock master synchronizes again with the clock reference and continues to drive the secondary CT bus clock based on the fallback reference.

Clock slave fallback

Clock fallback for a clock slave works as follows:

1. As long as the primary clock master is driving its CT bus clock, the clock slave uses this clock.
2. Upon detecting failure of the primary CT bus clock, the clock slave switches to the secondary CT bus clock.
3. If the secondary CT bus clock fails, the board falls back to its internal oscillator and continues to monitor the state of the secondary CT bus clock.
4. If the secondary CT bus clock is reestablished, the board synchronizes again with the secondary CT bus clock.

The following illustration shows a sample clock fallback configuration:



NETREF (NETREF1) and NETREF2

If you specify that any board use NETREF (NETREF1) or NETREF2 as a timing reference, you must configure one or two other boards to drive the signals. Configure a different board for each signal. The source for each signal must be a digital trunk.

Note: NETREF2 is available only in H.110 configurations.

Using NETREF with the TX 4000 board

The TX 4000 board has a single trunk group consisting of trunks 1, 2, 3, and 4. If the primary or fallback clock reference is a digital trunk, and the board is configured to drive NETREF, the same digital trunk must be configured for both the clocking reference source and the NETREF source. If a different digital trunk is selected for NETREF, this configuration is silently overridden, and the board drives NETREF from the digital trunk selected as the main or fallback clock source.

Using NETREF with the TX 4000C board

The TX 4000C board has two separate trunk groups. Trunk group one consists of trunks 1, 2, 5, and 6. Trunk group two consists of trunks 3, 4, 7, and 8. If the primary or fallback clock reference is a digital trunk, and the board is configured to drive NETREF, the NETREF source can be either:

- The same digital trunk used for the primary or fallback clock reference
- Any of the digital trunks in the other trunk group

If a different digital trunk in the same trunk group is selected to drive NETREF, this configuration is silently overridden, and the board drives NETREF from the digital trunk selected as the main or fallback clock source.

Configuring clocking (TX 4000/C)

The *txcfg.txt* clock command defines the clocking configuration of the TX 4000/C board main clock source. This clock is used as the internal clock for TX 4000/C boards. The clock signal can also be routed to other clocking signals. The clock source can be a clock signal of the H.100/H.110 bus, the TX board internal oscillator, or an oscillator or trunk connected to another device in the system (see *H.100 and H.110 bus clocking overview* on page 16).

If the clock command is not specified, the TX board remains in its default clocking mode (standalone mode). In this mode, the main clock source is the on-board oscillator. No clock signals are driven and clock fallback is disabled.

This topic presents:

- Clock command
- Configuring fallback
- Configuring NETREF

Clock command

The clocking configuration statement syntax is:

```
clock source [=network] outsigs [netref speed] [fallback source [=fallback network]]
```

where ***source*** specifies the source of the timing reference signal and is one of the following values:

Value	Description
a	H.100/H.110 bus A_CLOCK.
b	H.100/H.110 bus B_CLOCK.
nr1	H.100/H.110 bus NETREF or NETREF1.
nr2	H.100/H.110 bus NETREF2.
net	Clock derived from external network connection (T1/E1 trunk). When specifying net, use the =***network*** syntax to identify from which network trunk to extract the clock. For example, clock net=1 specifies using the clock derived from network trunk 1 as the board's clock source.
osc	On-board oscillator.

where ***outsigs*** specifies the clock signal to drive and is one of the following values:

Value	Description
a	Drive H.100/H.110 bus A_CLOCK.
b	Drive H.100/H.110 bus B_CLOCK.
-	Do not drive any H.100/H.110 bus A_CLOCK or B_CLOCK.

where ***netref speed*** optionally specifies the NETREF speed and is one of the following values:

Value	Description
8k	8 kHz NETREF clock signal.
15m	1.544 MHz NETREF clock signal.
20m	2.048 MHz NETREF clock signal.
-	Speed of NETREF clock signal not provided.

where ***fallback source*** optionally specifies the clock signal to fall back to and is one of the following values:

Value	Description
a	H.100/H.110 bus A_CLOCK.
b	H.100/H.110 bus B_CLOCK.
nr1	H.100/H.110 bus NETREF or NETREF1.
nr2	H.100/H.110 bus NETREF2.
net	Clock derived from external network connection (T1/E1 trunk). When specifying net, use the =***fallback network*** syntax to identify from which network trunk to extract the clock. For example, net=1 specifies fallback to clock derived from network trunk 1.
osc	On-board oscillator.

Note: If ***fallback source*** is not specified, clock fallback is disabled on the board.

Configuring fallback

Primary clock master

Follow these guidelines when configuring a TX 4000/C board as the primary clock master:

- Its primary timing reference must be a NETWORK reference. This timing reference can be any one of its T1/E1 trunks or the NETREF signal from the CT bus.
- Its fallback timing reference must be a different NETWORK reference.
- It must be configured to drive one of the CT bus clocks (A_CLOCK or B_CLOCK).

For example:

```
clock net=1 a - net=2
```

This clocking configuration receives the timing reference from network 1 clock, drives A_CLOCK, and falls back to network 2 clock.

Secondary clock master

Follow these guidelines when configuring a TX 4000/C board as the secondary clock master:

- It must receive its primary timing reference from the CT bus clock driven by the primary clock master (either A_CLOCK or B_CLOCK).
- It must drive the CT bus clock not driven by the primary master. For example, if the primary clock master is driving A_CLOCK, the secondary clock master must drive B_CLOCK. In this case, both clocks are synchronized.
- It must have a fallback timing reference. This timing reference must not be the primary clock master's primary or fallback timing reference.

For example:

```
clock a b - net=1
```

This clocking configuration receives the timing reference from A_CLOCK, drives B_CLOCK, and falls back to network 1 clock.

Clock slave

Follow these guidelines when configuring a TX 4000/C board as the clock slave:

- The primary clock source is the primary CT bus clock driven by the primary clock master.
- The fallback clock source is the secondary CT bus clock driven by the secondary clock master.

For example:

```
clock a - - b
```

This clocking configuration receives the timing reference from A_CLOCK and falls back to B_CLOCK.

Configuring NETREF

Use the *txcfg.txt* netref command to route a clock signal recovered from a specified T1/E1 network connection to the indicated H.100/H.110 bus NETREF signals. If the netref command is not specified, the TX 4000/C board does not drive any of the H.100/H.110 NETREF clock signals.

The NETREF clocking configuration statement syntax is:

```
netref network outsigs [netref speed]
```

where ***network*** is the network number (T1/E1 trunk number) from which to derive the clock signal, and ***outsigs*** specifies the clock signal to drive and is one of the following values:

Value	Description
nr1	Drive H.100/H.110 bus NETREF or NETREF1.
nr2	Drive H.100/H.110 bus NETREF2.
nr12	Drive H.100/H.110 bus NETREF1 AND NETREF2.
-	Do not drive any H.100/H.110 bus NETREF signal.

where ***netref speed*** optionally specifies the NETREF speed and is one of the following values:

Value	Description
8k	8 kHz NETREF clock signal.
15m	1.544 MHz NETREF clock signal.
20m	2.048 MHz NETREF clock signal.
-	Speed of NETREF clock signal not provided.

Configuring T1/E1 trunks (TX 4000/C)

The *txcfg.txt* T1/E1 configuration command determines whether a TX 4000/C board's trunk is configured as E1 (e1cfg), T1 (t1cfg), or J1 (j1cfg) mode. The configuration command consists of an identifier for the trunk being configured (1 through 4 for TX 4000, 1 through 8 for TX 4000C) and parameters specifying the circuit framing, line encoding, line buildout (T1/J1 only), and loop master configuration. This configuration statement defines the most common attributes of a trunk interface. Each T1/E1 command also supports an optional command that can be used to configure less common options for the given trunk type (E1 (e1opt), T1 (t1opt), J1 (j1opt)). Options must be specified before the trunk configuration command is specified.

This topic presents:

- E1 configuration
- T1 and J1 configuration

E1 configuration

Use the *txcfg.txt* e1cfg command to configure a trunk as an E1 interface. The information provided by the e1cfg command is combined with any information provided in previous e1opt commands to produce the full E1 trunk configuration information.

The E1 trunk configuration statement syntax is:

```
e1cfg trunk_num framing encoding master
```

where ***trunk_num*** is the trunk number to configure (1 through 4 for TX 4000, 1 through 8 for TX 4000C) and ***framing*** is one of the following values:

Value	Description
ccs	Clear channel signaling (double frame format).
cas	Channel associated signaling.
ccsrc	Clear channel signaling (CRC4 multiframe format).
casrc	Channel associated signaling (CRC4 multiframe format).

where ***encoding*** is one of the following values:

Value	Description
nozcs	AMI encoding with no zero code suppression.
hdb3	High density bipolar order 3.

where ***master*** is one of the following values:

Value	Description
true	Local side of connection acts as timing source for this circuit.
false	Remote side of connection acts as timing source.

E1 options

Use the e1opt command to control all E1 trunk configuration options that are not specified by the e1cfg command. The e1opt command does not send configuration requests to the TX board; the command modifies the optional configuration information attached to the E1 trunk configuration request issued by the e1cfg command. Because the E1 configuration options are not reset by an e1cfg command, all E1 options can be specified once and used for the configuration of each E1 trunk. A single e1opt command can be used to set up to 15 different options. Multiple e1opt commands can also be used.

The E1 trunk configuration options statement syntax is:

```
e1opt ! flag name value name=value
```

where

Parameter	Description
!	Clear a flag. Use to disable an option that is enabled by default.
flag name	Flag to set, or clear if ! is specified. See E1 option flags.
value name	Value to change. See E1 option values.
value	New value for named parameter.

E1 option flags

The following table lists the E1 option flags. If the default of the specified option flag is SET, use ! ***flag name*** to clear the flag.

Flag name	Description
EXZE	Extended code violation or excessive zero detection.
ALM	Standard by which AIS is detected. SET = ITU-T G.775; CLEAR = ETS300233. Default is SET.
SA6Y	Detection of Sa6-bit pattern done synchronously to multiframe.
EXTIW	Extended CRC4 to non-CRC4 interworking (search after 400 ms). Default is SET.
AXRA	Remote alarm bit set automatically if receiver in asynchronous state. Default is SET.
CRCI	Automatic CRC (4) bit inversion.

Flag name	Description
XCRCI	Transmission of CRC (4|6) bit inversion.
DCOXC	Center function of transmission circuitry enabled.
ALMF	Automatic loss of multiframe alignment when excessive CRC errors. Default is SET.
AXS	Automatic transmission of submultiframe status. Default is SET.
EBP	In asynchronous state, E-bit is set (valid only if AXS is set). Default is SET.
DAIS	Automatic AIS insertion disabled.
DAXLT	Automatic high impedance transmission pins on short detect disabled.
DXJA	Internal transmit jitter attenuation disabled.
DCF	Center function of receive circuitry disabled.
AFR	Automatic search for double frame alignment disabled.
XSIS	First bit of the service word. Default is SET.
XSIF	Transmission of spare bit for international use (FAS word). Default is SET.
XS13	Transmission of spare bit (frame 13, CRC-multiframe). Default is SET.
XS15	Transmission of spare bit (frame 15, CRC-multiframe). Default is SET.
SWD	Loss of synchronization based on service word disabled.
ASY4	Four consecutive incorrect FAS words cause LOS (CLEAR = 3).
EQON	-43 dB receiver (long hall mode). CLEAR = -10 dB (short haul).
RLM	Receiver mode for receive line monitoring.
CLOS	Received data is cleared as soon as LOS detected.
SCF	Corner frequency of DCO-R reduced by factor of 10 to 0.2 Hz.

E1 option values

Option name	Default	Valid range	Description
XP0	0x14	0x00 through 0x1F	Transmission of pulse shape mask (for 1st level).
XP1	0x13	0x00 through 0x1F	Transmission of pulse shape mask (for 2nd level).
XP2	0x00	0x00 through 0x1F	Transmission of pulse shape mask (for 3rd level).
XP3	0x00	0x00 through 0x1F	Transmission of pulse shape mask (for 4th level).
RIL	0x02	0x00 through 0x07	Receive input threshold.
SLT	0x02	0x00 through 0x03	Voltage threshold when receive slicer generates mark.
PCD	0x0A	0x00 through 0xFF	LOS alarm generated if no transmission in 16x(pcd+1) consecutive pulses.
PCR	0x15	0x00 through 0xFF	LOS alarm cleared if pcr+1 pulses in detect interval.
XY	0x1F	0x00 through 0x1F	Spare bits for national use.

T1 and J1 configuration

Use the *txcfg.txt* t1cfg command to configure a trunk as a T1 interface. The information provided by the t1cfg command is combined with information provided in previous t1opt commands to produce the full T1 trunk configuration information. As a variant of the standard T1 trunk configuration, use the j1cfg command to configure the trunk in J1 mode. The syntax for both the t1cfg and the j1cfg commands is identical.

The T1 trunk configuration statement syntax is:

```
t1cfg trunk_num framing encoding build_out master
```

The J1 trunk configuration statement syntax is:

```
j1cfg trunk_num framing encoding build_out master
```

where ***trunk_num*** is the trunk number to configure (1 through 4 for TX 4000, 1 through 8 for TX 4000C) and ***framing*** is one of the following values:

Value	Description
d4	D4 (193S) framing: 12-frame multiframe format (F12, D3/4).
f4	4-frame multiframe format (F4).
esf	Extended superframe format: 24-frame multiframe format (ESF).
f72	72-frame multiframe format (F72, remote switch mode).

where ***encoding*** is one of the following values:

Value	Description
nozsc	AMI encoding with no zero code suppression.
b7zs	Bit 7 stuffing with zero code suppression.
b8zs	Bipolar eight zero substitution.

where ***build_out*** is one of the following values:

Value	Transmitter attenuation
0	0 dB
1	-7.5 dB
2	-15 dB
3	-22.5 dB

where ***master*** is one of the following values:

Value	Description
true	Local side of connection acts as timing source for this circuit.
false	Remote side of connection acts as timing source.

T1 and J1 options

Use the t1opt or j1opt command to control all T1 or J1 trunk configuration options that are not specified by the t1cfg or j1cfg command. The t1opt or j1opt command does not send configuration requests to the TX board; the command modifies the optional configuration information attached to the T1 or J1 trunk configuration request issued by the t1cfg or j1cfg command. Because the T1 and J1 configuration options are not reset by a t1cgf or a j1cfg command, all T1 or J1 options can be specified once and used for the configuration of each T1 or J1 trunk. A single t1opt or j1opt command can be used to set up to 15 different options. Multiple t1opt or j1opt commands can also be used.

The T1 trunk configuration options statement syntax is:

```
t1opt ! flag name value name=value
```

The J1 trunk configuration options statement syntax is:

```
j1opt ! flag name value name=value
```

where

Parameter	Description
!	Clear a flag. Use to disable an option that is enabled by default.
flag name	Flag to set, or clear if ! is specified. See T1 and J1 option flags.
value name	Value to change. See T1 and J1 option values.
value	New value for named parameter.

T1 and J1 option flags

The following table lists the T1 and J1 option flags. If the default of the option flag is SET, use ! ***flag name*** to clear.

Flag name	Description
EXZE	Extended code violation or excessive zero detection.
SRAF	F12: FS-bit of frame 12; ESF: bit 2 = 0.
CRC	CRC6 check or generation (ESF format only) enabled. Default is SET.
AIS3	AIS detection only in asynchronous state.
SSC2	LFA declaration if more than 320 CRC6 errors per second.
RRAM	Detection of remote (yellow) alarm allowed during bit error rates.
LOS1	Additional condition for LOS alarm cleared: GR-499-CORE.
SJR	Alarm handling done according to ITU-T JG.704 and 706. Default is CLEAR (T1) and SET (J1).
AXRA	Remote alarm bit set automatically if receiver in asynchronous state. Default is SET.
CRCI	Automatic CRC(4) bit inversion.
XCRCI	Transmission of CRC(4|6) bit inversion.
DCOXC	Center function of transmit circuitry enabled.
DAIS	Automatic AIS insertion disabled.
DAXLT	Automatic high impedance transmission pins on short detect disabled.
DXJA	Internal transmit jitter attenuation disabled.
DCF	Center function of receive circuitry disabled.
EQON	-36 dB receiver (long haul mode). CLR = -10 dB (short haul).
RLM	Receiver mode for receive line monitoring.
CLOS	Received data is cleared as soon as LOS detected.
SCF	Corner frequency of DCO-R reduced by a factor of 10 to 0.6 Hz.
MCSP	Multiple candidates synchronization procedure.
SSP	Synchronization procedure.

T1 and J1 option values

Option name	Default	Valid range	Description
XP0	T1_XPM_0 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 1st level). See Line buildout values.
XP1	T1_XPM_1 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 2nd level). See Line buildout values.
XP2	T1_XPM_2 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 3rd level). See Line buildout values.
XP3	T1_XPM_3 (0xFF)	0x00 through 0x1F	Transmission of pulse shape mask (for 4th level). See Line buildout values.
RIL	0x00	0x00 through 0x07	Receive input threshold.
SLT	0x02	0x00 through 0x03	Voltage threshold when receive slicer generates mark.
PCD	0x00	0x00 through 0xFF	LOS alarm generated if no transmission in 16x(pcd+1) consecutive pulses.
PCR	0x00	0x00 through 0xFF	LOS alarm cleared if pcr+1 pulses in detection interval.
XY	0x00	0x00 through 0x1F	Spare bits for national use.
SSC	0x00	0x00 through 0x03	Synchronization conditions.

Line buildout values

The default values for the transmit pulse shape mask trigger the TX board to define the pulse shape according to the value of the EQON option flag and the value of the line buildout, as shown in the following table:

Line buildout	XP0	XP1	XP2	XP3
0 (short haul)	17	16	4	1
1 (short haul)	18	17	6	2
2 (short haul)	20	18	7	1
3 (short haul)	23	19	10	1
0 (long haul)	0	0	0	0
1 (long haul)	12	12	0	0
2 (long haul)	12	12	4	2
3 (long haul)	7	8	0	0

Configuring ports (TX 4000/C)

The *txcfg.txt* port command defines a full-duplex connection between the TX 4000/C board communication controller and a remote SS7 connection over either the H.100/H.110 bus or over one of the board's T1/E1 trunks. Port numbers are specified in the MTP configuration file as T***n*** where ***n*** is the port number.

The port command abstracts the TX board's internal local stream mapping scheme. Define dedicated TDM connections with this command. The connect command is an alternative to the port command to define a pair of half-duplex connections. However, because the connect command does not abstract the TX board's local stream mapping, NMS recommends that you use the port command for all SS7 TDM connection definitions.

This topic presents:

- Local stream mapping scheme
- Port command
- Connect command
- Examples

Local stream mapping scheme

Each TX board provides a number of SS7 resources (communication controllers) used to terminate SS7 links. For the TX 4000/C boards, these SS7 resources are addressed on local streams 72 and 73.

Use the *txcfg.txt* port command to define TDM connections to SS7 resources. A port command creates two half-duplex TDM connections between the communication controller and either a T1/E1 channel or an H.100/H.110 channel. The timeslot used to connect to the communication controller is always ***port number*** - 1. The timeslot used when defining a T1 port is in the range of 0 through 23. The timeslot used when defining an E1 port is in the range of 1 through 31.

The following table presents the local stream mapping scheme:

Trunk connections (T1 or J1 trunks)	Trunk 1: Streams 0 and 1, Trunk 2: Streams 4 and 5, Trunk 3: Streams 8 and 9, Trunk 4: Streams 12 and 13, Trunk 5: Streams 16 and 17, Trunk 6: Streams 20 and 21, Trunk 7: Streams 24 and 25, Trunk 8: Streams 28 and 29,	timeslots 0 through 23 timeslots 0 through 23 timeslots 0 through 23 timeslots 0 through 23 timeslots 0 through 23 (TX 4000C only) timeslots 0 through 23 (TX 4000C only) timeslots 0 through 23 (TX 4000C only) timeslots 0 through 23 (TX 4000C only)
Trunk connections (E1 trunks)	Trunk 1: Streams 0 and 1, Trunk 2: Streams 4 and 5, Trunk 3: Streams 8 and 9, Trunk 4: Streams 12 and 13, Trunk 5: Streams 16 and 17, Trunk 6: Streams 20 and 21, Trunk 7: Streams 24 and 25, Trunk 8: Streams 28 and 29,	timeslots 1 through 31 timeslots 1 through 31 timeslots 1 through 31 timeslots 1 through 31 timeslots 1 through 31 (TX 4000C only) timeslots 1 through 31 (TX 4000C only) timeslots 1 through 31 (TX 4000C only) timeslots 1 through 31 (TX 4000C only)
SS7 communication controller	Streams 72 and 73, timeslots 0 through 31	

Port command

The port statement syntax is:

```
port portnum bus outstream slot speed
```

where ***portnum*** is the port number to define (1 through 32 or * for HSL) and ***bus*** is one of the following values:

Value	Description
h100	Defines a connection across the H.100/H.110 bus.
local	Defines a connection across one of the TX board's local streams. This value is similar to the connect command since the TX board's local stream mapping scheme must be known to use this bus type.
e1	Defines a connection across a timeslot of an E1 trunk.
t1	Defines a connection across a timeslot of a T1 trunk.
j1	Defines a connection across a timeslot of a J1 trunk.

where ***outstream*** is interpreted based on the value of ***bus***:

If bus is...	Then outstream (and implied instream) is...
h100	Outbound H.100/H.110 stream number. The range is 0 through 31. If ***outstream*** is even, ***instream*** = ***outstream*** + 1. If ***outstream*** is odd, ***instream*** = ***outstream*** - 1.
local	Outbound local stream number. The range is based on the specific TX board type. See *Local stream mapping scheme* on page 34. ***instream*** = ***outstream***.
e1/t1/j1	One-based trunk number. The range is 1 through 4 for TX 4000 boards and 1 through 8 for TX 4000C boards. ***instream*** = ***outstream***.

where ***slot*** is interpreted based on the value of ***bus***:

If bus is...	Then slot is...
h100	Inbound and outbound H.100/H.110 timeslot number. The range is 0 through 127.
local	Inbound and outbound local timeslot number. The range is 0 through 31.
e1	Timeslot on the E1 trunk. The range is 1 through 31 or * for HSL. You cannot configure an SS7 port on E1 timeslot 0.
t1/j1	Zero-based timeslot number on the T1 (or J1) trunk. The range is 0 through 23 or * for HSL.

where ***speed*** is one of the following values (not used for HSL):

Value	Description
64	64 Kb connection (default speed of all port connections).
56	56 Kb connection.
48	48 Kb connection.

Connect command

Use the *txcfg.txt* connect command to define a half-duplex connection between any two TDM endpoints so that TDM timeslots not in use by SS7 links can be switched to other devices. To properly use the connect command, it is important to understand the TX board's local stream mapping scheme.

Note: For connections that terminate SS7 links, NMS recommends using the port command since it abstracts all knowledge of the TX board’s internal switching model.

The connect statement syntax is:

```
connect inbus instream inslot outbus outstream outslot
```

where ***inbus*** specifies the input source and is one of the following values:

Value	Description
h100	Input source is the stream and timeslot from the H.100/H.110 bus.
local	Input source is the stream and timeslot from one of the TX board's local streams (either a T1/E1 interface or an SS7 communication controller).

where ***instream*** is the inbound stream number: 0 through 31 (Hbus); 0 through ***n*** (local).

where ***inslot*** is the inbound timeslot: 0 through 127 (Hbus); 0 through 31 (local).

where ***outbus*** is one of the following values:

Value	Description
h100	Output endpoint is the stream and timeslot to the H.100/H.110 bus.
local	Output endpoint is the stream and timeslot to one of the TX board's local streams (either a T1/E1 interface or an SS7communication controller).

where ***outstream*** is the outbound stream number: 0 through 31 (Hbus); 0 through ***n*** (local).

where ***outslot*** is the outbound timeslot: 0 through 127 (Hbus); 0 through 31 (local).

Examples

This section presents the following port configuration examples:

- T1 example
- H.100/H110 example
- Example mapping of all non-signaling T1 channels (trunk 1) to H.100/H.110
- Example mapping of all non-signaling T1 channels (trunk 2) to trunk 3
- Example mapping of all non-signaling E1 channels (trunk 1) to H.100/H.110
- Example mapping of all non-signaling E1 channels (trunk 2) to trunk 3

T1 example

This command:

```
port 5 t1 2 7
```

creates the following TDM connections:

- Local stream 72 timeslot 4 transmitting to local stream 4 timeslot 7
- Local stream 4 timeslot 7 transmitting to local stream 72 timeslot 4

This command creates a full-duplex connection used by the MTP link defined as T5.

Local stream 72 connects to and from the SS7 communication controller with timeslot 4 (port number 5 - 1).

Local stream 4 connects to T1 trunk 2 with timeslot 7 mapping to T1 channel 7.

The same stream numbers are used for input and output connections when the stream is a local stream.

H.100/H.110 example

This command:

```
port 9 h100 2 7
```

creates the following TDM connections:

- Local stream 72 timeslot 8 transmitting to H.100 stream 2 timeslot 7
- H.100 stream 3 timeslot 7 transmitting to local stream 72 timeslot 8

This command creates a full-duplex connection used by the MTP link defined as T9.

Local stream 72 connects to and from the SS7 communication controller with timeslot 8 (port number 9 - 1).

H.100 stream 2 is specified as the output stream. This is an even stream number, so the corresponding input stream number is 2 + 1 = 3.

The same stream numbers are used for input and output connections for the local stream (connecting to the communication controller), while different streams are used to connect over the H.100 bus.

Example mapping of all non-signaling T1 channels (trunk 1) to H.100/H.110

This example shows the port and connect commands required to fully access the channels on T1 trunk 1.

The example creates a single SS7 port on T1 channel 0 (trunk 1) and maps all other channels of trunk 1 to the H.100/H.110 bus (transmitting to stream 30 and receiving from stream 31).

Command	Description
port 1 t1 1 0	Port 1 maps to T1 trunk 1 channel 0.
connect local 0 1 h100 30 1	Local stream 0 (trunk 1) channel 1 maps to H.100/H.110 stream 30 timeslot 1.
connect h100 31 1 local 0 1	H.100/H.110 stream 31 timeslot 1 maps to local stream 0 (trunk 1) channel 1.
connect local 0 2 h100 30 2	Local stream 0 (trunk 1) channel 2 maps to H.100/H.110 stream 30 timeslot 2.
connect h100 31 2 local 0 2	H.100/H.110 stream 31 timeslot 2 maps to local stream 0 (trunk 1) channel 2.
Pair of connect commands for channels 3 through 22	
connect local 0 23 h100 30 23	Local stream 0 (trunk 1) channel 23 maps to H.100/H.110 stream 30 timeslot 23.
connect h100 31 23 local 0 23	H.100/H.110 stream 31 timeslot 23 maps to local stream 0 (trunk 1) channel 23.

Example mapping of all non-signaling T1 channels (trunk 2) to trunk 3

This example shows the port and connect commands required to fully access the channels on T1 trunk 2.

The example creates a single SS7 port on T1 channel 23 (trunk 2) and maps all other channels of trunk 2 to trunk 3.

Command	Description
port 1 t1 2 23	Port 1 maps to T1 trunk 2 channel 23.
connect local 4 0 local 8 0	Local stream 4 (trunk 2) channel 0 maps to local stream 8 (trunk 3) channel 0.
connect local 8 0 local 4 0	Local stream 8 (trunk 3) channel 0 maps to local stream 4 (trunk 2) channel 0.
connect local 4 1 local 8 1	Local stream 4 (trunk 2) channel 1 maps to local stream 8 (trunk 3) channel 1.
connect local 8 1 local 4 1	Local stream 8 (trunk 3) channel 1 maps to local stream 4 (trunk 2) channel 1.
Pair of connect commands for channels 2 through 21	
connect local 4 22 local 8 22	Local stream 4 (trunk 2) channel 22 maps to local stream 8 (trunk 3) channel 22.
connect local 8 22 local 4 22	Local stream 8 (trunk 3) channel 22 maps to local stream 4 (trunk 2) channel 22.

Example mapping of all non-signaling E1 channels (trunk 1) to H.100/H.110

This example shows the port and connect commands required to fully access the channels on E1 trunk 1.

The example creates a single SS7 port on E1 channel 1 (trunk 1) and maps all other channels of trunk 1 to the H.100/H.110 bus (transmitting to stream 30 and receiving from stream 31).

Command	Description
port 1 e1 1 1	Port 1 maps to E1 trunk 1 channel 1.
connect local 0 2 h100 30 2	Local stream 0 (trunk 1) channel 2 maps to H.100/H.110 stream 30 timeslot 2.
connect h100 31 2 local 0 2	H.100/H.110 stream 31 timeslot 2 maps to local stream 0 (trunk 1) channel 2.
connect local 0 3 h100 30 3	Local stream 0 (trunk 1) channel 3 maps to H.100/H.110 stream 30 timeslot 3.
connect h100 31 3 local 0 3	H.100/H.110 stream 31 timeslot 3 maps to local stream 0 (trunk 1) channel 3.
Pair of connect commands for channels 4 through 30	
connect local 0 31 100 30 31	Local stream 0 (trunk 1) channel 31 maps to H.100/H.110 stream 30 timeslot 31.
connect h100 31 31 local 0 31	H.100/H.110 stream 31 timeslot 31 maps to local stream 0 (trunk 1) channel 31.

Example mapping of all non-signaling E1 channels (trunk 2) to trunk 3

This example shows the port and connect commands required to fully access the channels on E1 trunk 2.

The example creates a single SS7 port on E1 channel 31 (trunk 2) and maps all other channels of trunk 2 to trunk 3.

Command	Description
port 1 e1 2 31	Port 1 maps to E1 trunk 2 channel 31.
connect local 4 1 local 8 1	Local stream 4 (trunk 2) channel 1 maps to local stream 8 (trunk 3) channel 1.
connect local 8 1 local 4 1	Local stream 8 (trunk 3) channel 1 maps to local stream 4 (trunk 2) channel 1.
connect local 4 2 local 8 2	Local stream 4 (trunk 2) channel 2 maps to local stream 8 (trunk 3) channel 2.
connect local 8 2 local 4 2	Local stream 8 (trunk 3) channel 2 maps to local stream 4 (trunk 2) channel 2.
Pair of connect commands for channels 3 through 29	
connect local 4 30 local 8 30	Local stream 4 (trunk 2) channel 30 maps to local stream 8 (trunk 3) channel 30.
connect local 8 30 local 4 30	Local stream 8 (trunk 3) channel 30 maps to local stream 4 (trunk 2) channel 30.

4 Configuring TDM (TX 3220/C)

TDM configuration overview (TX 3220/C)

Before T1/E1 trunks or H.100/H.110 bus channels (also known as TDM channels) can be used for physical SS7 links, you must download a TDM configuration to the TX board. To configure a TX 3220/C board, create a TDM configuration file (*tdmcp**n**.txt* under Windows and *TDMcp**n**.txt* under UNIX) that defines TDM clocking control, configures all T1/E1 trunks, and defines all dedicated data channels. Each TX board in a system requires a separate TDM configuration file.

This topic presents:

- Sample TDM configuration files
- Common configuration changes

Sample TDM configuration files

NMS SS7 provides the following sample TDM files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. The sample TDM configuration files present the most common type of TX board use.

Files	Description
tdmcp1.txt (Windows) *TDMcp1.txt* (UNIX)	For a single TX 3220/C board in a chassis. This configuration file configures the board with a dual T1 daughterboard or a rear transition board. This configuration file specifies that the clock signal recovered from the first trunk connection (trunk A) is presented onto the A clock signals of the H.100/H.110 bus.
tdmcp2.txt (Windows) *TDMcp2.txt* (UNIX)	For two TX 3220/C boards in a chassis. This configuration file configures the second board with the T1 trunks set as loop master. This board is also configured as master of the H.100/H.110 bus A clock signals, using the board's internal oscillator to drive the clock.

For the location of the sample configuration files, see *Sample SS7 configurations* on page 9.

The following example shows a *tdmcp.txt* for a TX 3220/C board operating in T1 mode:

```
#          T1 Example
#          Timing Configurations:
#
CLOCK      NETA
SEC8K      NONE
#
# TX Port     MVIP Stream    Start Channel    Count     Direction
# -------     -----------    -------------    -----     ---------
   Port1         T1A           Channel0       Count1    Standard
   Port2         T1A           Channel23      Count1    Standard
   Port3         T1B           Channel0       Count1    Standard
   Port4         T1B           Channel23      Count1    Standard
#
# T1    Framing     Encoding    Buildout    Robbed Bit    Loop Master
# --    -------     --------    --------    ----------    -----------
  T1A      ESF         B8ZS          0          FALSE         FALSE
  T1B      ESF         B8ZS          0          FALSE         FALSE
```

The following example shows a *tdmcp.txt* for a TX 3220/C board operating in E1 mode:

```
#              E1 Example
     #         Timing Configurations:
     #
     CLOCK     NETA
     SEC8K     NONE
     #
     # TX Port    MVIP Stream   Start Channel   Count    Direction
     # -------    -----------   -------------   -----    ---------
        Port1       E1A          Channel1      Count1    Standard
        Port2       E1A          Channel31     Count1    Standard
        Port3       E1B          Channel1      Count1    Standard
        Port4       E1B          Channel31     Count1    Standard
     #
     # E1   Framing    Encoding   Buildout   Robbed Bit   Loop Master
     # --   -------    --------   --------   ----------   -----------
       E1A    CCS         HDB3         4         FALSE        FALSE
       E1B    CCS         HDB3         4         FALSE        FALSE
```

Common configuration changes

The following list provides some common TDM configuration changes required for different hardware configurations.

- If you use the V.35 serial interface rather than TDM ports (TX 3220/C boards only), do not define T1 or E1 trunks or ports in the TDM configuration file. Even though ports are not defined in the TDM configuration file when using V.35, you must change the SS7 link definition in the MTP 3 configuration file. See *Creating the MTP configuration* on page 49.
- Sample TDM configuration files are provided for both T1 (under ANSI directories) and E1 (under ITU directories). For T1 and E1 port definitions, the channel number is a value identifying to which timeslot to attach. For T1, channels 0 through 23 are available, providing access to all 24 timeslots of a T1 trunk. For E1, channels 1 through 31 are available, providing access to the 31 E1 timeslots beyond timeslot zero. Timeslot zero is used solely for framing on E1 trunks and cannot be used to transport data such as SS7.
- The sample configuration files contain commented out sections that define other types of TDM connections.
- Modify clocking control based on the specific environment. The sample configuration file for board 1 (*tdmcp1.txt*) assumes the board receives the clock signal from the first T1/E1 trunk, implying that the first T1/E1 is connected to another trunk that is acting as the loop master. The sample configuration file for board 2 (*tdmcp2.txt*) configures that board to act as the loop master for all its T1/E1 trunks. If this is not the configuration you want to use, modify the CLOCK field, the Loop Master field, or both.

After you modify the TDM configuration file for TX 3220/C boards, compile it into a binary image with the *tdmcfg* utility before downloading it to the board. See *Generating the binary file* on page 46.

For details on configuring TDM, see the following topics:

- *Configuring clocking (TX 3220/C)* on page 43
- *Configuring T1/E1 trunks (TX 3220/C)* on page 44
- *Configuring ports (TX 3220/C)* on page 45

Configuring clocking (TX 3220/C)

A TX communications processor can either provide an H.100 or an H.110 TDM bus interface. The clocking entry describes the clocking configuration for the H.100/H.110 bus clock signals and secondary 8K clock signals. The clocking configuration statement syntax is:

```
CLOCK clockmode
SEC8K sec8kmode
```

where ***clockmode*** is one of the following values:

Value	Description
BUS	Interface gets its timing signals from the H.100/H.110 bus (default).
MASTER	Interface drives the H.100/H.110 bus clock signals from its internal clock.
SEC8K	Interface drives the H.100/H.110 bus clock signals referenced from the H.100/H.110 secondary 8K signal.
NETA	Interface drives the H.100/H.110 bus clock signals and derives this timing from T1 interface A.
NETB	Interface drives the H.100/H.110 bus clock signals and derives this timing from T1 interface B.

where ***sec8kmode*** is one of the following values:

Value	Description
MASTER	Interface drives the SEC8K clock signals from its internal clock.
NETA	Interface drives the SEC8K clock signals and derives this timing from T1 interface A.
NETB	Interface drives the SEC8K clock signals and derives this timing from T1 interface B.
NONE	SEC8K clock is not driven by the interface (default).

Configuring T1/E1 trunks (TX 3220/C)

The T1/E1 configuration entry for TX 3220/C boards consists of an identifier for the circuit (A or B) being configured and parameters specifying the circuit framing, line encoding, line buildout, robbed bit signaling, and loop master configuration:

This parameter...	Determines...
Framing	Framing format to be used for this T1/E1 circuit. Valid values are: • None = Do not configure this T1/E1 circuit. • D4 = D4 (193S) framing (T1). • ESF = Extended superframe format (T1). • CCS = Frame alignment only (no multiframe alignment) (E1). • CAS = Standard frame alignment with channel associated signaling (timeslot 16) multiframe alignment (no CRC4) (E1). • CCSCRC4 = Standard frame alignment with CRC4 multiframe alignment (no CAS) (E1). • CASCRC4 = Standard frame alignment with both channel associated signaling (timeslot 16) and CRC4 multiframe alignment (E1).
Encoding	Line encoding and zero suppression mechanism to be used for this circuit. Valid values are: • NOZCS = AMI encoding with no zero code suppression (T1 or E1). • B7ZS = Bit seven zero stuffing (T1). • B8ZS = Bipolar eight zero substitution (T1). • HDB3 = High density bipolar (order 3) encoding (E1).
Buildout	Line buildout to be used for this T1/E1 circuit. Valid T1 values are: • 0 = 0 through 133 feet • 1 = 133 through 266 feet • 2 = 266 through 399 feet • 3 = 399 through 533 feet • 4 = 533 through 655 feet Valid E1 values are: 4 = 120 ohm normal with protection resistors. This is the default for E1.
Robbed Bit flag	Whether or not the TX board uses robbed bit signaling on this T1/E1 circuit. Set to TRUE or FALSE.
Loop Master flag	Whether or not this T1/E1 interface is the timing source for this circuit. Set to TRUE or FALSE.

Configuring ports (TX 3220/C)

The port definition entry defines the characteristics of each dedicated data channel. Channels are always defined as full-duplex connections. For the H.100/H.110 bus, stream ***n*** is always paired with stream ***n***+1.

The following table describes the port configuration parameters:

This parameter...	Identifies...
Port***n***	Port assigned to this data channel, where ***n*** is an integer in the range 1 ≤ ***n*** ≤ ***maxPorts*** and ***maxPorts*** depends on the hardware configuration. This port number is used when configuring other TX communication software to utilize this data channel.
Stream***n***	TDM stream that this channel occupies. • H.100/H.110 stream numbers are 0 through 30 (even numbers only). • T1/E1 streams are identified by name (T1A, E1A, T1B, E1B).
Channel***n***	Starting channel number. • H.100/H.110 uses channel numbers 0 through 127. • T1 uses channel numbers 0 through 23. • E1 uses channel numbers 1 through 31 (channel 0 is always reserved for framing).
Count***n***	Number of timeslots that make up this channel. Valid range is 1 through 32. **Note:** A special case exists for a 56 Kb or a 48 Kb subrate on a single DSO. If count is set to 56 or 48, the indicated subrate is allocated.
Direction	Direction of bus signals for H.100/H.110 channels. Valid values are: • Standard: Output on even stream (stream 0). Input on odd stream (stream 1). • Reverse: Output on odd stream (stream 1). Input on even stream (stream 0). • Reverse is only applicable to H.100/H.110 channels; T1/E1 channels must always be specified as standard.

Generating the binary file

Generate the binary TDM configuration file by running the *tdmcfg* utility on the text file according to the following syntax:

```
tdmcfg -i filename
```

where ***filename*** is the name of the TDM configuration text file (for example, *tdmcp1.txt*).

The configuration utility generates the following files:

File	Description
filename.*bin*	Binary configuration file.
filename.*dbg*	Text representation of the binary file.

5 Configuring MTP

MTP configuration overview

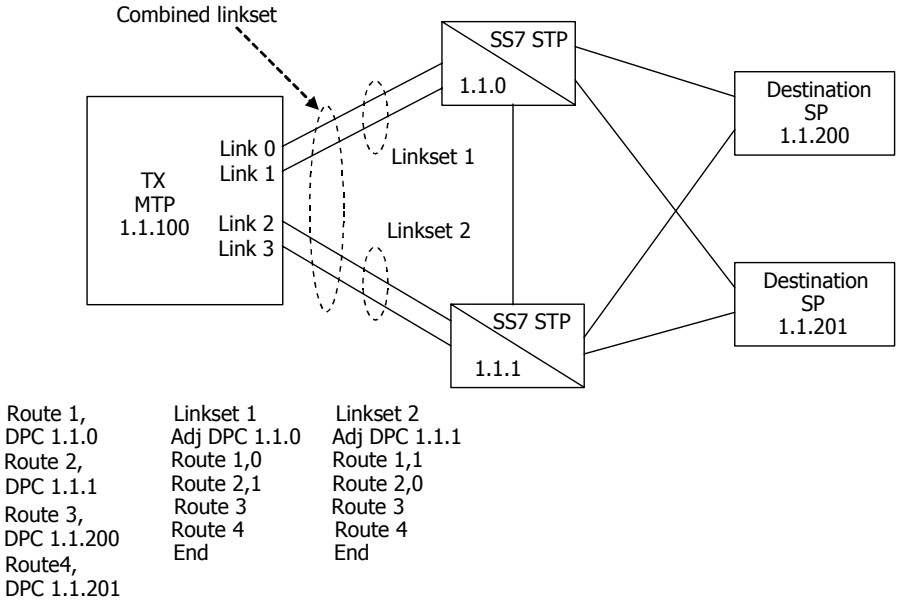
MTP 3 (Message Transfer Part 3) has two primary functions:

Function	Description
Message routing and distribution	Routes outgoing messages to specified destinations and distributes incoming messages to the appropriate user part or application. MTP uses a flexible configuration capable of supporting a wide variety of network routing and addressing requirements.
Signaling network management	Reconfigures the signaling network as needed to maintain signaling capability in the case of failures or congestion. This task includes redirecting traffic away from failed links and signaling points (SPs), restoring traffic to restored links or SPs, and exchanging route status with adjacent SPs. MTP 3 supports all required ANSI and ITU-T network management procedures without intervention from the user parts or applications.

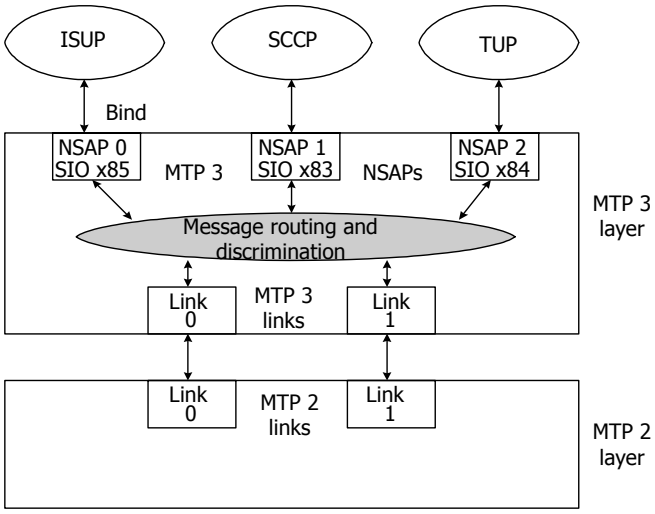
MTP implements services through the configuration of general parameters and the following entities:

Entity	Description
Links	Physical signaling links between the TX board and the adjacent signaling points. One link configuration must be performed for each physical signaling link.
Linksets	Groups of from one through 16 links that directly connect two signaling points. Although a linkset usually contains all parallel signaling links between two SPs, it is possible to define parallel linksets. Each defined signaling link is assigned membership in one linkset.
Routes	Destination signaling points (sub-networks or clusters when route masks are employed) accessible from the target node. Each route is assigned a direction, up or down. One up route is required for the actual point code assigned to the signaling point being configured and for each point code that is to be emulated. Up routes are used to identify incoming messages that are to be routed up to the applications or user parts. One down route is required for each remote signaling point, network, or cluster accessible from the SP being configured. Down routes are used to route outgoing messages to the appropriate signaling links. Each down route is assigned to all linksets that can be used to reach that destination. Each linkset within the route's associated combined linkset can be assigned an optional priority. MTP routing chooses the highest priority available linkset when routing an outgoing packet to a particular destination.
Network service access points (NSAPs)	SS7 user parts or applications that are MTP users. Each NSAP is associated with one user part or application as identified by the service indicator field of a message, and one protocol variant (ITU-T or ANSI).

The following illustration shows the relationship between links, linksets, and routes:



The following illustration shows the concept of network service access points (NSAPs):



If multiple protocol variants are configured on the same MTP 3 instance (same board), two NSAPs are required for each user part: one for ANSI and one for ITU-T. In this case, a single user part or application can associate itself with both NSAPs for that service, or separate user part or applications can be used for each protocol variant.

MTP configuration considerations

Configure MTP 3 as either a signal transfer point (STP) or as a signaling end point (SP). The primary difference between STP operation and SP operation is the handling of messages that MTP 3 receives from signaling links that are addressed to other destinations.

When configured as an STP, MTP 3 searches for an outbound route to the message destination and, if found, routes the message over an outbound link. When configured as an SP, MTP 3 discards such messages.

When configured as an STP, MTP 3 also performs the additional signaling route management procedures required of an STP. These procedures include notifying adjacent SPs when they must no longer route messages to a particular destination through that STP due to failures or congestion (transfer prohibited/restricted), and notifying them again when normal communication with the concerned destination is restored (transfer allowed).

Creating the MTP configuration

NMS SS7 provides the following sample files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications:

Files	Description
mtp3cp1.cfg (Windows) *MTP3cp1.cfg* (UNIX)	MTP 3 file for board 1.
mtp3cp2.cfg (Windows) *MTP3cp2.cfg* (UNIX)	MTP 3 file for board 2.

To learn the location of the sample configuration files, see *Sample SS7 configurations* on page 9.

The NMS MTP configuration utilities, *mtp3cfg* and *mtp2cfg,* run as part of the initial board configuration with *ss7load.* The utilities read the text configuration file and download the specified configuration to the MTP task on the TX board. *mtp3cfg* configures the MTP layer 3. *mtp2cfg* is optional. Run it only to override the default MTP layer 2 parameters assigned to each link. You can also run *mtp3cfg* and *mtp2cfg* after initial configuration to dynamically update some configuration parameters.

This topic presents:

- Sample MTP 3 configuration file
- MTP 3 configuration file structure

Sample MTP 3 configuration file

The following example is the ANSI configuration file for board 1 in the two-board sample configuration:

```
#-----------------------------------------------
# Overall MTP3 Parameters
#-----------------------------------------------
NODE_TYPE          STP        # choose STP [routing] or SP [non-routing]
PC_FORMAT          DFLT       # Point code format:  DFLT (8.8.8) / INTL (3.8.3) /
#                               JNTT (7.4.5)
POINT_CODE         1.1.1
RESTART_REQUIRED   TRUE
VALIDATE_SSF       FALSE
MAX_LINKS          4
MAX_USERS          2          # sccp & isup
MAX_ROUTES         64
MAX_ROUTE_ENTRIES  1024
MAX_LINK_SETS      2
MAX_ROUTE_MASKS    1
ROUTE_MASK         0xFFFFFFFF
END
#
#-----------------------------------------------
# Link Parameters
#-----------------------------------------------
LINK               0          #  Link number specified in MTPMGR commands
PORT               T1         #  T<n> for T1/E1, S<n> for serial (V.35), R for
#                                remote
LINK_SET           1
LINK_TYPE          ANSI       #  ANSI / ITU / JNTT / JTTC
ADJACENT_DPC       1.1.2      #  Board 2
LINK_SLC           0
LSSU_LEN           2
SSF                NATIONAL   # NATIONAL / INTERNATIONAL
END
#
# Sample Serial (V.35) configuration
#
#LINK               S1         #  T<n> for T1/E1, S<n> for serial (V.35)
#LINK_SET           1
#LINK_TYPE          ANSI       #  ANSI / ITU / JNTT / JTTC
#ADJACENT_DPC       1.1.2      #  Board 2
#LINK_SLC           0
#LSSU_LEN           2
#SSF                NATIONAL   # NATIONAL / INTERNATIONAL
#INT_TYPE           DCE
#BAUD               56000
#END
#
#-----------------------------------------------
# User Parameters (NSAP definition)
#-----------------------------------------------
NSAP               0          # isup must be NSAP 0 if its present
LINK_TYPE          ANSI       # ANSI / ITU / JNTT / JTTC
END
#
NSAP               1          # sccp can be 0 or 1, must be 1 if isup present
LINK_TYPE          ANSI       # ANSI / ITU / JNTT / JTTC
END
#
#-----------------------------------------------
# Routing Parameters
#-----------------------------------------------
#
# Route UP from network to applications on this node
#
ROUTE              0
DPC                1.1.1      # this node
LINK_TYPE          ANSI       # ANSI / ITU / JNTT / JTTC
```

```
DIRECTION           UP          # default is DOWN
ADJACENT_ROUTE      FALSE
END
#
# Route to board 2
#
ROUTE               1
DPC                 1.1.2       # board 2's point code
LINK_TYPE           ANSI        # ANSI / ITU / JNTT / JTTC
END
#
#
#-----------------------------------------------
# Linkset Parameters
#-----------------------------------------------
LINK_SET_DESCRIPTOR       1
ADJACENT_DPC              1.1.2       # link set to board 2
MAX_ACTIVE_LINKS          4
ROUTE_NUMBER              1
END
#
```

MTP 3 configuration file structure

This topic discusses the following sections of the configuration file:

General configuration section

Links configuration section

Network service access points (NSAPs) section

Route definition section

Linkset definition section

General configuration section

The general configuration parameters define and control the general operation of the signaling point (SP) implemented by the NMS SS7 software. General configuration parameters include:

- Type of signaling point being constructed (SP or STP)
- Point code assigned to the signaling point
- MTP 3 timer resolution
- Values for various SP-level timers
- Maximum number of other configurable elements (NSAPs, links, linksets, routes) to control memory allocation

The general parameters are configured once at board download time, before any other entities are configured. The board must be downloaded again to change any of the general configuration parameters.

Links configuration section

The links configuration section defines the physical signaling links between the TX board and the adjacent signaling points. It contains a link configuration block for each SS7 link. The MTP 3 and MTP 2 configuration utilities scan the links section. The links section is the only section scanned by the MTP 2 configuration utility. Each link configuration block is composed of both layer 3 parameters and layer 2 parameters, in any order.

The layer 3 configurable attributes of a link include:

- Link number
- Port and port type (serial or TDM) assigned to a link
- Point code of the adjacent signaling point
- Protocol variant employed on the link
- Point code length
- Maximum packet length
- Various timer values
- Membership in a linkset

The layer 2 configurable attributes include:

- All layer 2 timers
- LSSU length to be used on the link
- Interface type (DCE or DTE) and baud rate for V.35 serial links
- Whether this is a high speed link (HSL)
- Whether extended sequence numbers are to be used for a HSL

V.35 configuration

If you use V.35 serial links (TX 3220/C boards only) rather than TDM links, change the link 1 definition from port T1 to port S1. Then specify one side of the link (board 1) as the DCE and the other side of the link (board 2) as the DTE. The V.35 pod port for the link configured as the DCE must be strapped for DCE operation, and the V.35 pod port for the link configured as the DTE must be strapped for DTE operation. See the appropriate board installation manual for details on configuring the V.35 pod.

Network service access points (NSAPs) section

Network service access points (NSAPs) define the SS7 user parts, or applications, that are MTP users. The configurable attributes of NSAPs include:

- Protocol variant and point code length supported by the user part or application associated with the NSAP
- Maximum number of user part or application messages to be queued (at each of the four possible message priority levels) when flow control between the MTP 3 and the application is in effect

Route definition section

Routes specify the destination signaling points (sub-networks or clusters when route masks are employed) that are accessible from the node being configured. Each route is assigned an up or down direction. Up routes are used to identify incoming messages that are to be routed up to the applications or user parts. One down route is required for each remote signaling point, network, or cluster accessible from the SP being configured. Down routes are used to route outgoing messages to the appropriate signaling links.

Other configurable attributes of routes include:

- Destination point code
- Protocol variant in use at the destination SP, cluster, or network
- Timers associated with MTP route management

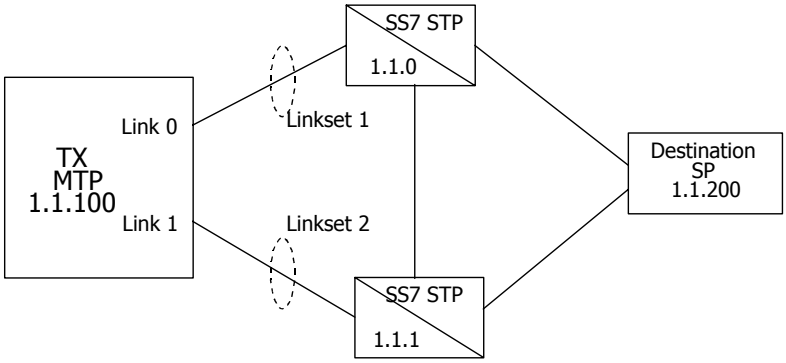
Linkset definition section

The linkset section defines each linkset between the TX board and the adjacent signaling points. Linksets are numbered from 1 to MAX_LINKSETS (MAX_LINKSETS is a general configuration section parameter). The configurable attributes of a linkset include:

- Point code of the adjacent signaling point
- List of routes that are accessible from that linkset
- Number of links to attempt to keep active

Configuring routes to non-adjacent nodes

You may need to configure non-adjacent signaling points. A non-adjacent signaling point is a signaling point that is not directly connected to the MTP 3 layer but is accessible through a signaling point that is directly connected. The following illustration shows this type of configuration:



Follow this procedure to configure a non-adjacent signaling point:

Step	Action
1	Configure all links, linksets, and routes to adjacent signaling points as described in the sample configuration files.
2	Add a route entry (direction down) for the non-adjacent SP, specifying its point code as the destination of the route.
3	Add the route number for the non-adjacent SP to the linkset entry for each linkset that can be used to reach the non-adjacent destination.

Since the non-adjacent SP in the illustration (point code 1.1.200) is accessible from both STPs, the route entry for 1.1.200 is added to the linkset definitions for both linksets 1 and 2. Since the STPs are cross connected, the route to each STP is also added to both linksets 1 and 2 since STP 1.1.1 can be reached directly through linkset 2 or indirectly through linkset 1 with STP 1.1.0.

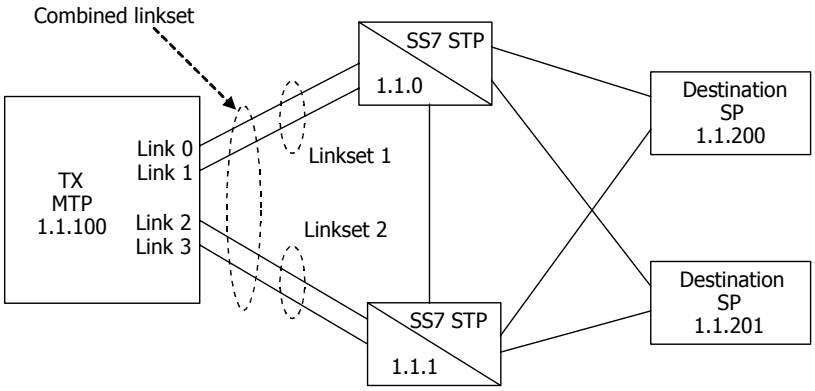
The following example MTP configuration file configures non-adjacent signaling points:

```
<General Parameters>
#
#Link Parameters
#
LINK                      T1       # Link 0 to STP 1.1.0
LINK_SET                  1
ADJACENT_DPC              1.1.0
END
#
LINK                      T2       # Link 1 to STP 1.1.1
LINK_SET                  2
ADJACENT_DPC              1.1.1
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200
END
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR       1
ADJACENT_DPC              1.1.0    # link set to STP 1.1.0
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
#
LINK_SET_DESCRIPTOR       2
ADJACENT_DPC              1.1.1    # link set to STP 1.1.1
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
```

Using priorities

Priority levels range from 0 (highest) to 15 (lowest). To use priorities, start with zero for the highest priority linkset for a given route and increment by one for lower priority linksets for that route. There can be no gaps in the priority assigned for a given route, although equal priorities are allowed.

Use linkset priorities to ensure that the shortest path is taken by a message, when available. In the following illustration, messages destined for STP 1.1.0 use linkset 1 (when available) and not linkset 2, which would require an extra hop through STP 1.1.1. Messages to STP 1.1.1 use linkset 2, if available:



To ensure that linkset 1 is always chosen for messages to STP 1.1.0, if available, a higher priority is assigned to route 1 in linkset 1. The same is done for STP 1.1.1, route 2, and linkset 2. Linkset priorities are defined in the configuration file by placing a comma and the priority after a route number in the linkset definition.

Note: Route 1 (STP 1.1.0) is assigned priority zero in linkset 1 and priority 1 in linkset 2, indicating linkset 1 is higher priority than linkset 2 for messages destined for STP 1.1.0. Route 2 (STP 1.1.1) is assigned the reverse priorities. Routes 3 and 4 have no priorities assigned to them, indicating both linksets are of equal priority for reaching SP 1.1.200 and SP 1.1.201. When a priority is not specified, the default of zero (highest) is assigned. Therefore specifying 3,0 and 4,0 in both linksets has the same result as not specifying a priority level at all. They are configured as equal priority because no matter which linkset is chosen, a message to either 1.1.200 or 1.1.201 requires two hops.

The following configuration sample shows how to specify linkset priorities for the illustrated example:

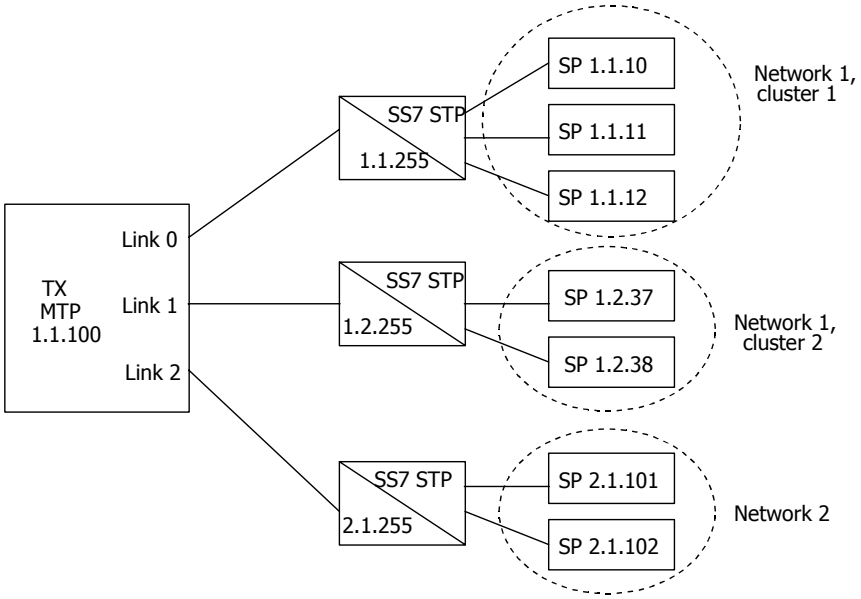
```
#
# Routing Parameters
#
ROUTE           0
DPC             1.1.100      # this node
DIRECTION       UP
END
#
ROUTE           1
DPC             1.1.0        # STP 1.1.0
END
#
ROUTE           2
DPC             1.1.1        # STP 1.1.1
END
#
ROUTE           3
DPC             1.1.200      # SP 1.1.200
ADJACENT_ROUTE  FALSE        # Route to non-adjacent SP 1.1.200
END
#
ROUTE           4
DPC             1.1.201      # STP 1.1.201
ADJACENT_ROUTE  FALSE        # Route to non-adjacent SP 1.1.201
END
#
# Link Set Parameters
#
LINK_SET_DESCRIPTOR  1
ADJACENT_DPC         1.1.0
ROUTE_NUMBER         1,0
ROUTE_NUMBER         2,1
ROUTE_NUMBER         3
ROUTE_NUMBER         4
END

LINK_SET_DESCRIPTOR  2
ADJACENT_DPC         1.1.1
ROUTE_NUMBER         1,1
ROUTE_NUMBER         2,0
ROUTE_NUMBER         3
ROUTE_NUMBER         4
END
```

Using routing masks

Use routing masks to help decrease the size of the routing tables that must be configured. Routing masks are bit masks that specify a subset of a destination point code to be matched against the routing table when searching for a route for either an inbound or outbound message.

Use routing masks to implement network and cluster routing in ANSI networks. In the following example, rather than specifying explicit routes to each of the seven remote SPs, routing masks and routes are used. All point codes and routing masks, regardless of point code length, are stored internally as 32-bit unsigned integers. Routing masks are also useful when implementing server-type applications, such as service control points (SCPs), where it is impractical to preconfigure the point codes of all possible requester signaling points.

Routing masks are global to all links, linksets, and user parts, and apply to both incoming and outgoing messages.



The following table shows typical routing masks used in ANSI networks for routing based on network or cluster IDs. Routing masks are applied to a message in the order in which they appear in the MTP configuration file. The first matching mask or route is the one selected.

Routing mask	Comment
0xFFFFFFFF	Always specify exact match as first mask.
0xFFFFFF00	Match on network ID and cluster ID next.
0xFFFF0000	Match on just network ID last.

The following partial MTP configuration file configures routing masks:

```
MAX_ROUTE_MASKS          3
ROUTE_MASK               0xFFFFFFFF     # always specify exact match 1st
ROUTE_MASK               0xFFFFFF00     # cluster mask next
ROUTE_MASK               0xFFFF0000     # network mask next
<Link Parameters>
#Routing Parameters
ROUTE                    0
DPC                      1.1.100        # Route up to this node
DIRECTION                UP
END
#
ROUTE                    1
DPC                      1.1.255        # Explicit route to STP 1.1.255
END
#
ROUTE                    2
DPC                      1.2.255        # Explicit route to STP 1.2.255
END
#
ROUTE                    3
DPC                      2.1.255        # Explicit route to STP 2.1.255
END
#
ROUTE                    4
DPC                      1.1.0          # Partial route to cluster 1.1.x
ADJACENT_ROUTE           FALSE          # Route to non-adjacent cluster 1.1.x
END
#
ROUTE                    5
DPC                      1.2.0          # Partial route to cluster 1.2.x
ADJACENT_ROUTE           FALSE          # Route to non-adjacent cluster 1.2.x
END
#
ROUTE                    6
DPC                      2.0.0          # Partial route to network 2.x.y
ADJACENT_ROUTE           FALSE          # Route to non-adjacent cluster 2.x.y
END
# Link set Parameters
LINK_SET_DESCRIPTOR      1
ADJACENT_DPC             1.1.255        # link set to STP 1.1.255
ROUTE_NUMBER             1              # explicit route to 1.1.255
ROUTE_NUMBER             4              # cluster route to 1.1.x
END
#
LINK_SET_DESCRIPTOR      2
ADJACENT_DPC             1.2.255        # link set to STP 1.2.255
ROUTE_NUMBER             2              # explicit route to 1.2.255
ROUTE_NUMBER             5              # cluster route to 1.2.x
END
#
LINK_SET_DESCRIPTOR      3
ADJACENT_DPC             2.1.255        # link set to STP 2.1.255
ROUTE_NUMBER             3              # explicit route to 2.1.255
ROUTE_NUMBER             6              # network route to 2.x.y
END
#
```

Although the previous example is specific to ANSI networks, routing masks can be applied equally to other networks to reduce the size of routing tables.

When using routing masks and partial-match routes, follow these guidelines:

- Always configure an up route with the TX board point code first.
- Always configure an explicit route to each node directly connected to the TX board.
- Always configure an exact match routing mask (0xFFFFFFFF) before configuring any partial match routing masks.

Configuring multiple OPC emulation

You can configure MTP to act as multiple point codes to the network and receive and send inbound traffic destined to a number of point codes. This configuration can be used to:

- Bridge multiple networks, as in a gateway application
- Provide a service from a single application to multiple networks
- Test applications

This topic presents:

- Configuring multiple OPC emulation for a single network
- Emulating different point codes to directly connected signaling points
- Configuring multiple OPC emulation for multiple networks

Configuring multiple OPC emulation for a single network

To configure multiple OPC emulation for a single network in MTP, configure an up route for each of the point codes to be emulated. The following sample configuration file shows how to configure MTP to act as point codes 1.1.100, 1.2.200, and 1.3.300 to the network. The modifications are shown in **bold** type. Higher layer traffic for the extra point codes is passed to a registered (bound) upper layer rather than being discarded as undeliverable. In this configuration, MTP is 1.1.100 to both adjacent signaling points for MTP management messages. Links and linksets still have an OPC equal to the general OPC of 1.1.100.

```
<General Parameters>
NODE_TYPE    STP
POINT_CODE    1.1.100  # This node's point code
#
#Link Parameters
#
LINK                      T1       # Link 0 to STP 1.1.0
LINK_SET                  1
ADJACENT_DPC              1.1.0
END
#
LINK                      T2       # Link 1 to STP 1.1.1
LINK_SET                  2
ADJACENT_DPC              1.1.1
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200
END
#
ROUTE                     4
DPC                       1.2.200  # emulated point code
DIRECTION                 UP
END
#
ROUTE                     5
DPC                       1.3.300  # emulated point code
DIRECTION                 UP
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR       1
ADJACENT_DPC              1.1.0    # link set to STP 1.1.0
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
#
LINK_SET_DESCRIPTOR       2
ADJACENT_DPC              1.1.1    # link set to STP 1.1.1
ROUTE_NUMBER              1
ROUTE_NUMBER              2
ROUTE_NUMBER              3
END
```

While the previous configuration allows upper layers to receive messages directed to 1.2.200 and 1.3.300, this is not sufficient for all upper layers to operate properly (for example, NMS ISUP). ISUP requires that a RESUME indication be returned for each OPC/DPC combination for which it has circuits defined, so it can activate those circuits and respond to incoming IAM messages. In the previous configuration, when linkset 1 or 2 become available, only one RESUME indication with OPC/DPC (1.1.100/1.1.200) is generated. This does not include the RESUME indications generated for the STPs. There is only one down route that is not to an STP, and that route uses the general OPC by default.

MTP generates a RESUME for each available down route using the OPC and DPC associated with that route. Therefore, if you are using NMS ISUP with multiple OPCs or your own application requires RESUMES for all OPC/DPC combinations, you must add a down route for each combination.

The following example shows how to add down routes so that RESUMES are generated for each OPC/DPC combination. The modifications are shown in **bold** type.

```
<General Parameters>
NODE_TYPE    STP
POINT_CODE    1.1.100  # This node's point code
#
#Link Parameters
#
LINK                      T1       # Link 0 to STP 1.1.0
LINK_SET                  1
ADJACENT_DPC              1.1.0
END
#
LINK                      T2       # Link 1 to STP 1.1.1
LINK_SET                  2
ADJACENT_DPC              1.1.1
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200
END
#
ROUTE                     4
DPC                       1.2.200  # emulated point code
DIRECTION                 UP
END
#
ROUTE                     5
DPC                       1.3.300  # emulated point code
DIRECTION                 UP
END
#
```

```
ROUTE                       6
OPC                         1.2.200  # emulated point code
DPC                         1.1.200  # Route to non-adjacent 1.1.200

END
#
ROUTE                       7
OPC                         1.3.300  # emulated point code
DPC                         1.1.200  # Route to non-adjacent 1.1.200
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR         1
ADJACENT_DPC                1.1.0    # link set to STP 1.1.0
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
ROUTE_NUMBER                6
ROUTE_NUMBER                7
END
#
LINK_SET_DESCRIPTOR         2
ADJACENT_DPC                1.1.1    # link set to STP 1.1.1
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
ROUTE_NUMBER                6
ROUTE_NUMBER                7
END
```

In the previous configuration RESUMES are generated for three OPC/DPC combinations (not including the RESUMES for the adjacent STPs). These combinations are:

OPC	DPC
1.1.100	1.1.200
1.2.200	1.1.200
1.3.300	1.1.200

Emulating different point codes to directly connected signaling points

If MTP needs to emulate different point codes to directly connected signaling points (as in a gateway application), the configuration must include the emulated OPCs in the link and linkset definitions, in addition to the additional up routes. The following example shows the modifications in **bold** type. In this configuration, MTP acts as 1.1.100 to the STP 1 network and 1.2.200 to the STP 2 network. Traffic is received for all three point codes from either network.

```
<General Parameters>
NODE_TYPE    STP
POINT_CODE    1.1.100  # This node's point code
#
#Link Parameters
#
LINK                        T1       # Link 0 to STP 1.1.0
LINK_SET                    1
ADJACENT_DPC                1.1.0

OPC     1.1.100
END
#
```

```
LINK                        T1       # Link 1 to STP 1.1.1
LINK_SET                    2
ADJACENT_DPC                1.1.1

OPC   1.2.200
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                       0
DPC                         1.1.100  # this node
DIRECTION                   UP
END
#
ROUTE                       1
DPC                         1.1.0    # STP 1.1.0
END
#
ROUTE                       2
DPC                         1.1.1    # STP 1.1.1
END
#
ROUTE                       3
DPC                         1.1.200  # Route to non-adjacent 1.1.200
END
#
ROUTE                       4
DPC                         1.2.200  # emulated point code
DIRECTION                   UP
END
#
ROUTE                       5
DPC                         1.3.300  # emulated point code
DIRECTION                   UP
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR         1
ADJACENT_DPC                1.1.0    # link set to STP 1.1.0

OPC    1.1.100
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
END
#
LINK_SET_DESCRIPTOR         2
ADJACENT_DPC                1.1.1    # link set to STP 1.1.

OPC    1.2.200
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
END
```

The OPC lines for link 1 and linkset 1 are not required since the OPC always defaults to the general configuration point code when not specified. However, the OPC makes it clearer that point code emulation is being used and that the linksets (and their respective links) are using different OPCs. If an OPC different from the general configuration point code is specified in a linkset or in one or more of its links but not both, the specified point code is propagated to the entities where OPC is unspecified. If two different OPCs are specified for a linkset and for one or more of its links, an alarm is generated and the second entity encountered is not configured.

To avoid confusion when emulating different point codes to directly connected signaling points, NMS recommends that you specify the OPCs in each link and linkset and make sure they match between the linkset and the links.

Configuring multiple OPC emulation for multiple networks

In the previous configurations, outbound traffic is routed by destination point code (DPC) and signaling link selector (SLS) only. For multiple network configurations, use OPC_ROUTING = TRUE to specify that outbound routing take into account the OPC.

The following configuration defines two routes to 1.1.200 with differing OPCs. Traffic to 1.1.200 with an OPC of 1.1.100 is routed over link/linkset 1, and traffic to 1.1.200 with an OPC of 1.2.200 is routed over link/linkset 2. The modifications are shown in **bold** type.

```
<General Parameters>
NODE_TYPE    STP

POINT_CODE    1.1.100  # This node's point code

OPC_ROUTING    TRUE
#
#Link Parameters
#
LINK                      T1       # Link 0 to STP 1.1.0
LINK_SET                  1
ADJACENT_DPC              1.1.0

OPC     1.1.100
END
#
LINK                      T2       # Link 1 to STP 1.1.1
LINK_SET                  2
ADJACENT_DPC              1.1.1

OPC                       1.2.200
END
#
#Routing Parameters
#
# Route UP from network to applications on this node
#
ROUTE                     0
DPC                       1.1.100  # this node
DIRECTION                 UP
END
#
ROUTE                     1
DPC                       1.1.0    # STP 1.1.0

OPC                       1.1.100
END
#
ROUTE                     2
DPC                       1.1.1    # STP 1.1.1

OPC                       1.2.200
END
#
ROUTE                     3
DPC                       1.1.200  # Route to non-adjacent 1.1.200

OPC                       1.1.100
END
#
```

```
ROUTE                       4
DPC                         1.1.200  # Route to non-adjacent 1.1.200

OPC                         1.2.200
END
#
ROUTE                       5
DPC                         1.2.200  # emulated point code
DIRECTION                   UP
END
#
ROUTE                       6
DPC                         1.3.300  # emulated point code
DIRECTION                   UP
END
#
#
# Link set Parameters
#
LINK_SET_DESCRIPTOR         1
ADJACENT_DPC                1.1.0    # link set to STP 1.1.0
OPC    1.1.100
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                3
END
#
LINK_SET_DESCRIPTOR         2
ADJACENT_DPC                1.1.1    # link set to STP 1.1.1
OPC    1.2.200
ROUTE_NUMBER                1
ROUTE_NUMBER                2
ROUTE_NUMBER                4
END
```

If OPC_ROUTING is FALSE, traffic to 1.1.200 is shared across linksets 1 and 2 because the OPC is not taken into account for outbound routing.

Configuring MTP for the Japan-NTT variant

Follow these guidelines when configuring the MTP layer for Japan-NTT network operation:

- Set the LINK_TYPE attribute for all links, NSAPs, and route entries to JNTT.
- The point code length for links and NSAPs defaults to 16 after the LINK_TYPE is set to JNTT. If desired for documentation purposes, the point code length can be explicitly set to 16 (the only supported value for JNTT link type) in the link and NSAP configurations.
- Specify the 16-bit point codes in either hexadecimal or ***x.y.z*** dotted notation. Specify hexadecimal point codes in the order in which they are transmitted on the link: the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits. To specify J-NTT 16-bit point codes in ***x.y.z*** notation, set the PC_FORMAT parameter in the MTP 3 general configuration section to the value JNTT.

For example:

```
PC_FORMAT     JNTT
...
LINK          S1
LINK_TYPE     JNTT
ADJACENT_DPC  1.1.2
...
```

is equivalent to:

```
...
LINK          S1
LINK_TYPE     JNTT
ADJACENT_DPC  0x421
...
```

Sample MTP configuration file for the Japan-NTT protocol variant

The following sample MTP 3 configuration file configures two V.35 serial links with the JNTT protocol variant:

```
#-----------------------------------------------------
# Sample MTP3 configuration for J-NTT protocol variant
#-----------------------------------------------------
#Overall MTP3 Parameters
#-----------------------
#
NODE_TYPE           SP            # choose STP [routing] or SP [non-routing]
PC_FORMAT           JNTT
POINT_CODE          1.1.1
RESTART_REQUIRED    FALSE
MAX_LINKS           4
MAX_USERS           2             # isup + 1 extra
MAX_ROUTES          64
MAX_ROUTE_ENTRIES   1024
MAX_LINK_SETS       2
MAX_ROUTE_MASKS     1
ROUTE_MASK          0xFFFFFFFF
END
#
#Link Parameters
#---------------
#
# Link 0
#
LINK                S1            # Serial port 1
LINK_SET            1
LINK_TYPE           JNTT
ADJACENT_DPC        1.1.2
LINK_SLC            0
LSSU_LEN            1
INT_TYPE            DCE
BAUD                56000
END
#
# Link 1
#
LINK                S2            # Serial port 2 (V.35)
LINK_SET            1
LINK_TYPE           JNTT
ADJACENT_DPC        1.1.2
LINK_SLC            1
LSSU_LEN            1
INT_TYPE            DCE
BAUD                56000
END
#
#User Parameters (NSAP definition)
#---------------------------------
#
```

```
NSAP                0            # isup
LINK_TYPE           JNTT
END
#
NSAP                1            # spare
LINK_TYPE           JNTT
END
#
#
#Routing Parameters
#------------------
#
# Route UP from network to applications on this node
#
ROUTE               0
LINK_TYPE           JNTT
DPC                      1.1.1   # this node
DIRECTION           UP           # default is DOWN
ADJACENT_ROUTE      FALSE
END
#
# Route to Adjacent node
#
ROUTE               1
LINK_TYPE           JNTT
DPC                 1.1.2
END
#
#
# Linkset Parameters
#-------------------
LINK_SET_DESCRIPTOR 1
ADJACENT_DPC        1.1.2
MAX_ACTIVE_LINKS    4
ROUTE_NUMBER        1
END
#
```

Configuring MTP for the Japan-TTC variant

Follow these guidelines when configuring the MTP layer for Japan-TTC network operation:

- Set the LINK_TYPE attribute for all links, NSAPs, and route entries to JTTC.
- The point code length for links and NSAPs defaults to 16 when the LINK_TYPE is set to JTTC. If desired for documentation purposes, the point code length can be explicitly set to 16 (the only supported value for JTTC link type) in the link and NSAP configurations.
- Specify the 16-bit point codes in either hexadecimal or ***x.y.z*** dotted notation. Specify hexadecimal point codes in the order in which they are transmitted on the link: the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits. To specify J-NTT or J-TTC 16-bit point codes in ***x.y.z*** notation, set the PC_FORMAT parameter in the MTP 3 general configuration section to the value JNTT.

For example:

```
PC_FORMAT     JNTT
...
LINK          T1
LINK_TYPE     JTTC
ADJACENT_DPC  1.1.2
...
```

is equivalent to:

```
...
LINK          T1
LINK_TYPE     JTTC
ADJACENT_DPC  0x421
...
```

- Set the following general parameters:
  - RESTART_REQUIRED to FALSE.
  - DISABLE_UPU to TRUE.
- Set the following parameters for each link definition:
  - LSSU_LEN to 1.
  - IDLE_FREQ to 24.
  - RT_FREQ to 24.

Sample MTP configuration file for the Japan-TTC protocol variant

The following sample MTP 3 configuration file configures two T1/E1 links with the JTTC protocol variant. The required settings are shown in **bold** type.

```
#-----------------------------------------------------
# Sample MTP3 configuration for J-TTC protocol variant
#-----------------------------------------------------
#Overall MTP3 Parameters
#-----------------------
#
NODE_TYPE           SP           # choose STP [routing] or SP [non-routing]
PC_FORMAT           JNTT         # Note this is not JTTC
POINT_CODE          1.1.1
RESTART_REQUIRED    FALSE
DISABLE_UPU         TRUE
MAX_LINKS           4
MAX_USERS           2            # isup + 1 extra
MAX_ROUTES          64
MAX_ROUTE_ENTRIES   1024
MAX_LINK_SETS       2
MAX_ROUTE_MASKS     1
ROUTE_MASK          0xFFFFFFFF
END
#
#Link Parameters
#---------------
#
# Link 0
#
LINK                T1           # TDM port 1
LINK_SET            1
LINK_TYPE           JTTC
ADJACENT_DPC        1.1.2
LINK_SLC            0
LSSU_LEN            1
RT_FREQ 24
IDLE_FREQ 24
END
#
```

```
# Link 1
#
LINK                T2           # TDM port 2
LINK_SET            1
LINK_TYPE           JTTC
ADJACENT_DPC        1.1.2
LINK_SLC            1
LSSU_LEN            1
RT_FREQ 24
IDLE_FREQ 24
END
#
#User Parameters (NSAP definition)
#---------------------------------
#
NSAP                0           # isup
LINK_TYPE           JTTC
END
#
NSAP                1           # spare
LINK_TYPE           JTTC
END
#
#
#Routing Parameters
#------------------
#
# Route UP from network to applications on this node
#
ROUTE               0
LINK_TYPE           JTTC
DPC                  1.1.1       # this node
DIRECTION           UP          # default is DOWN
ADJACENT_ROUTE      FALSE
END
#
# Route to Adjacent node
#
ROUTE               1
LINK_TYPE           JTTC
DPC                 1.1.2
END
#
#
# Linkset Parameters
#-------------------
LINK_SET_DESCRIPTOR 1
ADJACENT_DPC        1.1.2
MAX_ACTIVE_LINKS    4
ROUTE_NUMBER        1
END
#
```

Configuring high speed links (HSL)

High speed links (HSL) meet the ANSI T1.111-1996 and Q.703/Annex A standards. Each HSL occupies a full (unchannelized) T1/E1 line and transfers data at the rate of 2.0 (1.544) Mbps.

Parameters

Configuring high speed links in MTP uses two parameters, HS_LINK and HS_EXT_SEQ, which are contained in the Link section of the configuration file. The following table describes these parameters:

Parameter	Description
HS_LINK	Setting this parameter to TRUE, notifies MTP that high speed links are in effect and automatically sets HS_EXT_SEQ to TRUE. Set HS_EXT_SEQ to FALSE for high speed links with normal sequence numbers.
HS_EXT_SEQ	Setting this parameter to TRUE, notifies MTP that extended sequence numbers are in effect and changes the size of: • FSN, BSN, and LI fields in MTP 2 packets • The last FSN field of COO and COA messages at layer 3 Sequence numbers increase from 7 to 12 bits and the length indicator increases from 6 to 8 bits. Setting HS_EXT_SEQ to TRUE automatically sets HS_LINK to TRUE. Normal speed links with extended sequence numbers are not supported.

A combination of high speed and normal speed links is not supported.

High speed link configuration example

The following sample configuration file shows the configuration for high speed links:

```
#-----------------------------------------------
# Link Parameters
#-----------------------------------------------
LINK                0           #  Link number specified in MTPMGR commands
PORT                T1          #  T<n> for T1/E1, S<n> for serial (V.35), R for
                                #  remote
HS_LINK             TRUE
HS_EXT_SEQ          TRUE
LINK_SET            1
LINK_TYPE           ANSI        #  ANSI / ITU / JNTT / JTTC
ADJACENT_DPC        1.1.2       #  Board 2
LINK_SLC            0
LSSU_LEN            2
SSF                 NATIONAL    # NATIONAL / INTERNATIONAL
END
```

MTP configuration reference

This topic presents the MTP configuration file parameters:

- General parameters
- Link parameters
- NSAP parameters
- Routing parameters
- Linkset parameters

General parameters

The following table lists the configurable parameters in the MTP 3 general configuration section. The default values for all timers at the MTP 3 level are shown below in tenths of a second. The default resolution when setting timers in the MTP3 configuration file is in seconds. Use the MTP3_TIMER_RES general parameter to specify if timer values being overridden in the MTP 3 configuration file are in seconds or tenths of a second. A configuration value of zero for a timer disables that timer.

Note: The PC_FORMAT parameter applies to all point codes in the MTP configuration file.

Parameter	Default	Valid values	Description
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Use for both Japan NTT and TTC networks. Point codes are interpreted and displayed as 16-bit ***mcode.scode.ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
POINT_CODE	None	N/A	Point code of this node, specified in dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101). This parameter is required.
NODE_TYPE	STP	STP SP	Mode of operation. STP = transfer functionality SP = no transfer functionality
POINT_CODE2	None	N/A	Alternate point code for this node when supporting both ANSI and ITU-T networks from the same board. Specify the ITU-T point code in the POINT_CODE parameter and the ANSI point code here.
MTP3_TIMER_RES	SECONDS	SECONDS TENTHS	Whether timer values in the configuration file are specified in seconds or tenths of a second.
RESTART_REQUIRED	TRUE	TRUE/YES FALSE/NO	If TRUE, full restart procedure is required whenever node becomes accessible.

Parameter	Default	Valid values	Description
VALIDATE_SSF	TRUE	TRUE/YES FALSE/NO	If TRUE, MTP 3 validates incoming MTP 3 signaling network management (SNM) and test (SLTM/SLTA) messages. Messages with an SSF that does not match the value configured for the link on which the message was received are rejected. If FALSE, the SSF is not checked on incoming MTP 3 management or test messages (any SSF value is accepted). MTP 3 does not validate the SSF in any incoming or outgoing user part messages.
DISABLE_UPU	FALSE	TRUE/YES FALSE/NO	If TRUE, MTP never sends a User Part Unavailable message.
MAX_LINKS	4	1 through 16 (TX 3220/C) 1 through 32 (TX 4000/C)	Maximum number of physical links (actual maximum depends on TX board model and hardware configuration).
MAX_USERS	2	1 through 64	Maximum number of MTP 3 users (user parts).
MAX_ROUTES	32	1 through 32767	Maximum number of routes.
MAX_ROUTE_ENTRIES	1024	1 through 32767	Maximum number of route instances. Logical maximum is MAX_ROUTES * number of SLS values (16 - ITU, 32 - ANSI), but this number can be decreased.
MAX_LINK_SETS	1	1 through 16	Maximum number of supported linksets.
MAX_ROUTE_MASKS	0	0 through 8	Maximum number of routing masks. If zero, all destination point codes in outgoing messages must exactly match a point code in a route entry.
ROUTE_MASK	None	0x00 through 0xFFFFFFFF	Routing mask to be applied to destination point code before matching against routing table entries. Use to reduce the number of routes that must be configured or use if remote destination point codes are not known at configuration time (a database server). You can specify multiple ROUTE_MASKs. They are applied in the order in which they appear in the configuration file.
TIMER_T15	30	0 through 65535	Time to wait to start or repeat route set congestion test.
TIMER_T16	20	0 through 65535	Time to wait for route set congestion status update.
TIMER_T18_ITU	300	1 through 65535	ITU restart timer for an STP during which links are restarted and TFA, TFR, and TFP messages are received.
TIMER_T20_ITU	600	1 through 65535	ITU overall restart timer.
TIMER_T22_ANSI	300	1 through 65535	ANSI restart timer at restarting SP waiting for links to become available.

Parameter	Default	Valid values	Description
TIMER_T23_ANSI	300	1 through 65535	ANSI restart timer at restarting SP waiting for TRA messages.
TIMER_T26_ANSI	130	1 through 65535	ANSI restart timer at restarting SP waiting to repeat TRW message.
TIMER_T27_ANSI	30	1 through 65535	Minimum duration of unavailability for full restart.
TIMER_TRTEINST	18000	0 through 65535	Internal route instance timer (how long a route instance is valid). Not ANSI T30.
MTP3_TRACE_DATA	FALSE	TRUE FALSE	If TRUE, start tracing of all data between MTP 2 and MTP 3.
OPC_ROUTING	FALSE	TRUE FALSE	If TRUE, outbound routing takes into account OPC values, as well as DPC and SLS values. If FALSE, outbound routing takes into account only DPC and SLS values. Refer to *Configuring multiple OPC emulation* on page 59 for more information.
TRANSPARENT_MODE	FALSE	TRUE FALSE	If TRUE, all inbound traffic is passed up to the SIO matching bound application regardless of DPC or OPC values. All outbound traffic is shared across all links regardless of DPC or OPC values. If FALSE, normal routing is in effect.
END	N/A	N/A	Marks the end of the general parameters section. This parameter is required.

Link parameters

The following tables list the MTP 3 and MTP 2 configuration parameters applicable to each link:

MTP 3 link parameters

Parameter	Default	Valid values	Description
PORT	None	S1 through 4 (serial) T1 through 16|32 (TDM) R (remote)	S***n*** for serial (V.35) (TX 3220 or TX 3220C only). T***n*** for T1, E1, H.100, and H.110. R for remote links (links on the other board in a redundant system).
LINK	None	0 through 15|31	Zero-based link number. Use this number to refer to the link in MTPMGR commands.
LINK_TYPE	ANSI	ANSI ITU JNTT JTTC	MTP 3 protocol variant used on link.
ADJACENT_DPC	None	N/A	Point code of the node on the other end of the link. Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).
OPC	None	N/A	Originating point code. Use for multiple OPC emulation and OPC routing. Refer to *Configuring multiple OPC emulation* on page 59 for more information.
LINK_SET	1	1 through 16	Linkset to which this link belongs.
SSF	NATIONAL (ANSI) INTERNATIONAL (ITU-T)	NATIONAL INTERNATIONAL	Value used in the subservice field (SSF) of the SIO.
SUB_SERVICE	2	0 through 3	Overrides SSF parameter. Use either SUB_SERVICE or the SSF parameter.
LINK_PRIORITY	0	0 through 3	Priority of this link within the link set.
MESSAGE_SIZE	272	64 through 1024	Maximum message length for this link.
DISABLED	FALSE	TRUE FALSE	If TRUE, link is initially disabled. No attempt is made to align with the remote side without manual intervention. If FALSE, link is initially enabled. It tries to align with the remote side immediately.

Parameter	Default	Valid values	Description
USE_PRIORITY	TRUE	TRUE FALSE	If TRUE, message priorities generated by user parts are inserted into the SIO octet (spare bits) of outgoing messages. If FALSE, the SIO spare bits are set to zero. Usually set to TRUE in ANSI networks and FALSE in ITU-T networks.
MGNT_MSG_PRIORITY	3	0 through 3	Priority to use for MTP3 management messages.
DPC_LENGTH	24 (ANSI) 14 (ITU) 16 (JNTT/JTTC)	14 16 24	Number of bits in a point code.
MAX_SLTM_RETRY	2	0 through 255	Maximum times to retry signaling link test messages (SLTM) before disabling the link. A value of zero results in infinite retries.
HS_LINK	FALSE	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that high speed links are in effect and automatically sets HS_EXT_SEQ to TRUE. Set HS_EXT_SEQ to FALSE for high speed links with normal sequence numbers. **Note:** Layers 2 and 3 use this parameter.
HS_EXT_SEQ	FALSE	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that extended sequence numbers are in effect and changes the size of: • FSN, BSN, and LI fields in MTP 2 packets • The last FSN field of COO and COA messages at layer 3 Sequence numbers increase from 7 to 12 bits and the length indicator increases from 6 to 8 bits. Setting HS_EXT_SEQ to TRUE automatically sets HS_LINK to TRUE. Normal speed links with extended sequence numbers are not supported. **Note:** Layers 2 and 3 use this parameter.
P0QUE_LENGTH	16	2 through 1024	Transmit queue length threshold at which the congestion priority is raised to level 0.
P1QUE_LENGTH	32	(p0Qlen + 2) through 1024	Transmit queue length threshold at which the congestion priority is raised to level 1.

Parameter	Default	Valid values	Description
P2QUE_LENGTH	64	(p1Qlen + 2) through 1024	Transmit queue length threshold at which the congestion priority is raised to level 2.
P3QUE_LENGTH	128	(p2Qlen + 2) through 1024	Transmit queue length threshold at which the congestion priority is raised to level 3.
DISCARD_PRIORITY	0	0 through 3	Congestion priority at which messages with priority below the current threshold are discarded rather than being queued and risking further congestion escalation.
LINK_SLC	0	0 through 15	Link selection code for signaling link testing.
LINK_TEST_PATTERN	TST	1 through 15 ASCII characters	Link test pattern for SLTM messages.
TIMER_T1	10	0 through 65535	Time delay to avoid an out-of-sequence condition on changeover.
TIMER_T2	10	0 through 65535	Time to wait for changeover acknowledgment.
TIMER_T3	10	0 through 65535	Time delay to avoid an out-of-sequence condition on changeback.
TIMER_T4	10	0 through 65535	Time to wait for first changeback acknowledgment (first attempt).
TIMER_T5	10	0 through 65535	Time to wait for first changeback acknowledgment (second attempt).
TIMER_T6	10	0 through 65535	Time delay to avoid an out-of-sequence condition on controlled rerouting.
TIMER_T7	20	0 through 65535	Time to wait for data link connection acknowledgment.
TIMER_T11	600	0 through 65535	Transfer restricted timer.
TIMER_T12	12	0 through 65535	Time to wait for uninhibit acknowledgment.
TIMER_T13	10	0 through 65535	Time to wait for forced uninhibit.
TIMER_T14	30	0 through 65535	Time to wait for inhibit acknowledgment.
TIMER_T17	10	0 through 65535	Time delay to avoid oscillation of initial alignment failure and link restart.
TIMER_T22	1100	0 through 65535	Time to wait to repeat local inhibit test (ANSI T20 value).
TIMER_T23	1100	0 through 65535	Time to wait to repeat remote inhibit test (ANSI T21 value).
TIMER_T24	40	0 through 65535	Reserved for future use (not ANSI T24).

Parameter	Default	Valid values	Description
TIMER_T31	50	0 through 65535	Internal BSN requested timer (not ANSI T31).
TIMER_T32	100	0 through 65535	Time to wait for response to SLTM timer (ANSI T1.111.7 timer T1, not ANSI T32).
TIMER_T33	200	0 through 65535	Signaling link connection timer (not ANSI T33).
TIMER_T34	600	0 through 65535	Periodic signaling link test timer (ANSI T1.111.7 timer T2, not ANSI T34).
TIMER_T40	30	1 through 65535	Time to wait for a bind confirmation from MTP 2 before sending another bind request.
TIMER_T41	30	1 through 65535	Time to wait for a disconnect confirmation from MTP 2 before sending another disconnect request.
TIMER_T42	30	1 through 65535	Time to wait for a flow control confirmation from MTP 2 before sending another flow control request.
TIMER_T43	30	1 through 65535	Time to wait for a status confirmation from MTP 2 before sending another status request.
TIMER_T44	30	1 through 65535	Time to wait for an unbind confirmation from MTP 2 before sending another unbind request.
LINK_TRACE_DATA	FALSE	TRUE FALSE	If TRUE, starts tracing of all data between MTP 2 and MTP 3 on this link.
END	N/A	N/A	Marks the end of this link definition. This parameter is required.

MTP 2 link parameters

All layer 2 timer values are specified in tenths of a second (60 = 6 seconds).

Parameter	Default	Valid values	Description
ERR_TYPE	NORMAL	NORMAL PCR	Error correction method. NORMAL = normal PCR = preventive cyclic retransmission
HS_LINK	False	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that high speed links are in effect and automatically sets HS_EXT_SEQ to TRUE. Set HS_EXT_SEQ to FALSE for high speed links with normal sequence numbers. **Note:** Layers 2 and 3 use this parameter.
HS-EXT_SEQ	False	TRUE FALSE	Setting this parameter to TRUE, notifies MTP that extended sequence numbers are in effect and changes the size of: • FSN, BSN, and LI fields in MTP 2 packets • The last FSN field of COO and COA messages at layer 3 Sequence numbers increase from 7 to 12 bits and the length indicator increases from 6 to 8 bits. Setting HS_EXT_SEQ to TRUE automatically sets HS_LINK to TRUE. Normal speed links with extended sequence numbers are not supported. **Note:** Layers 2 and 3 use this parameter.
L2_T1	130 (ANSI) 400 (ITU-T)	1 through 65535	Timer aligned and ready.
L2_T2	115 (ANSI) 100 (ITU-T)	1 through 65535	Timer not aligned.
L2_T3	115 (ANSI) 15 (ITU-T)	1 through 65535	Timer aligned.
L2_T4_N	23 (ANSI) 82 (ITU-T)	1 through 65535	Normal proving period.
L2_T4_E	6 (ANSI) 5 (ITU-T)	1 through 65535	Emergency proving period.
L2_T5	1	1 through 65535	Timer sending busy indications (SIBs).
L2_T6	60	1 through 65535	Timer remote congestion.

Parameter	Default	Valid values	Description
L2_T7	20	1 through 65535	Timer excessive delay of acknowledgement.
L2_T10	30	1 through 65535	Amount of time MTP 2 can be isolated from a remote MTP 3 before sending processor outage (SIPO).
L2_T11	20	1 through 65535	Time to wait for a flow control acknowledgement from MTP 3 before sending another flow control indication.
L2_T12	20	1 through 65535	Time to wait for a status confirmation from MTP 3 before sending another status indication.
L2_T13	20	1 through 65535	Time to wait for a disconnect confirmation from MTP 3 before sending another disconnect indication.
LSSU_LEN	2	1 through 2	LSSU length.
MAX_FRAME	272	64 through 1024	Maximum frame length for MSU.
SUERM_THRESH	64	1 through 255	Signal unit error rate monitor threshold (bad frames).
SUERM_D_RATE	256	1 through 65535	Signal unit error rate monitor decrement rate (frames).
AERM_THRESH_E	1	1 through 255	Alignment error rate monitor threshold (emergency alignment).
AERM_THRESH_N	4	1 through 255	Alignment error rate monitor threshold (normal alignment).
MAX_RTB_MSGS	127	1 through 255	Maximum number of MSUs for retransmission (only when using PCR error correction).
MAX_RTB_OCTETS	34544	1 through 65535	Maximum number of MSU octets for retransmission (only when using PCR error correction).
MAX_PROV_ABORT	5	1 through 255	Maximum number of proving failures.
BAUD	56000	4800 9600 19200 28800 38400 48000 56000 64000	Baud rate for serial ports only (in bits per second).
INT_TYPE	DTE	DTE DCE	Interface type for serial ports only.
DATA_ENC	NRZ	NRZ NRZI	Data encoding.
SHARE_FLAGS	TRUE	TRUE FALSE	If TRUE, allow a single flag to be shared between frames.

Parameter	Default	Valid values	Description
USE_FLAGS	TRUE	TRUE FALSE	If TRUE, use flags between frames. If FALSE, idle between frames.
MIN_FLAGS	0	0 through 15	Minimum number of additional flags between frames (in addition to shared flag).
ISO_THRESH	1000	1 through 65535	Number of messages queued to MTP 3 while isolated that cause MTP 2 to begin processor outage (SIPOs).
L2_TXQ_THRESH1	50	1 through 65535	Transmission queue length at which the outbound flow control level is raised to one.
L2_TXQ_THRESH1_A	20	1 through 65535	Transmission queue length at which the outbound flow control level is lowered to zero.
L2_TXQ_THRESH2	200	1 through 65535	Transmission queue length at which the outbound flow control level is raised to two. The subsequent indication causes MTP 3 to cease all transmission to MTP 2 until the flow control level returns to one or zero.
L2_TXQ_THRESH2_A	100	1 through 65535	Transmission queue length at which the outbound flow control level is lowered to one.
L2_SAP_THRESH	500	1 through 65535	Number of messages queued to MTP 3 while inbound flow control is in effect that cause MTP 2 to send busy indications (SIBs).
L2_SAP_THRESH_A	100	1 through 65535	Number of messages queued to MTP 3 while inbound flow control is in effect that cause MTP 2 to stop sending busy indications (SIBs).
IDLE_FREQ	0	1 through 65535	Frequency at which FISUs are sent by the software (in ms). Zero indicates that hardware constantly retransmits duplicate FISUs as is the norm. Switches that process all FISUs in the software (including duplicate FISUs) can use non-zero frequencies.
RT_FREQ	0	1 through 65535	Frequency at which other retransmitted SUs (LSSUs) are sent by the software (in ms). Zero indicates that hardware constantly retransmits duplicate LSSUs as is the norm. Switches that process all FISUs in the software (including duplicate FISUs) can use non-zero frequencies.
END	N/A	N/A	Marks the end of this link definition. This parameter is required.

Network service access point (NSAP) parameters

The following table lists the parameters used for defining an NSAP:

Parameter	Default	Valid values	Description
NSAP	None	0 through MAX_USERS - 1	NSAP number. This parameter is required.
LINK_TYPE	ANSI	ANSI ITU JNTT JTTC	MTP 3 protocol variant used by this MTP 3 user part.
P0QUE_LENGTH	0	2 through 1024	Receive queue length threshold at which the congestion priority is raised to level 0.
P1QUE_LENGTH	512	(p0Qlen + 2) through 1024	Receive queue length threshold at which the congestion priority is raised to level 1.
P2QUE_LENGTH	768	(p1Qlen + 2) through 1024	Receive queue length threshold at which the congestion priority is raised to level 2.
P3QUE_LENGTH	896	(p2Qlen + 2) through 1024	Receive queue length threshold at which the congestion priority is raised to level 3.
DPC_LENGTH	24 (ANSI) 14 (ITU-T) 16 (JNTT/JTTC)	14 16 24	Number of bits in a point code.
END	N/A	N/A	Marks the end of this NSAP definition. This parameter is required.

Routing parameters

The following table lists the configurable parameters for an MTP 3 route entry:

Parameter	Default	Valid values	Description
ROUTE	None	0 through MAX_ROUTES	Route identifier number. This parameter is required.
DPC	None	N/A	Point code that is the target of the route entry. Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).
OPC	None	N/A	Originating point code. Use for multiple OPC emulation and OPC routing. Refer to *Configuring multiple OPC emulation* on page 59 for more information.
SPTYPE	STP	SP STP	Destination signaling point type.
LINK_TYPE	ANSI	ANSI ITU JNTT JTTC	MTP 3 protocol variant associated with this route.
SSF	NATIONAL (ANSI) INTERNATIONAL (ITU-T)	NATIONAL INTERNATIONAL	Value for the sub-service field (SSF) to be used in route management messages for this route.

Parameter	Default	Valid values	Description
SUB_SERVICE	2	0 through 3	Overrides SSF parameter. Use either SUB_SERVICE or the SSF parameter.
DIRECTION	DOWN	UP DOWN	Route direction. Up routes result in messages being routed to user parts or applications on this node; Down routes are routes to remote signaling points.
ADJACENT_ROUTE	TRUE	TRUE|YES FALSE|NO	If TRUE, this is a route to an adjacent signaling point (a signaling point that is directly connected to this node).
ADJACENT_CLUSTER	FALSE	TRUE|YES FALSE|NO	If TRUE, this is a route to any cluster, enabling use of the cluster variant of route management messages (ANSI only).
TIMER_T8	10	0 through 65535	Transfer prohibited inhibition timer.
TIMER_T10	450	0 through 65535	Time to wait to start or repeat periodic route set test.
TIMER_T19_ITU	680	1 through 65535	ITU restart timer to avoid ping-pong of TFP, TFR, or TRA messages.
TIMER_T21_ITU	640	1 through 65535	Overall ITU restart timer at adjacent SP.
TIMER_T25_ANSI	320	1 through 65535	ANSI restart timer at adjacent SP waiting for a TRA message.
TIMER_T28_ANSI	300	1 through 65535	ANSI restart timer at adjacent SP waiting for a TRW message.
TIMER_T29_ANSI	630	1 through 65535	ANSI restart timer started when a TRA is sent in response to an unexpected TRA or TRW.
TIMER_T30_ANSI	320	1 through 65535	ANSI restart timer to limit sending of TFPs and TFRs in response to an unexpected TRA or TRW.
END	N/A	N/A	Marks the end of this route definition. This parameter is required.

Linkset parameters

The following table lists the parameters for defining a linkset:

Parameter	Default	Valid values	Description
LINK_SET_DESCRIPTOR	None	1 through MAX_LINKSETS	Linkset identifier number; referenced in LINK_SET parameter of each individual link.
ADJACENT_DPC	None	N/A	Point code of the adjacent SP that terminates this linkset. Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).
OPC	None	N/A	Originating point code. Use for multiple OPC emulation and OPC routing. Refer to *Configuring multiple OPC emulation* on page 59 for more information.
MAX_ACTIVE_LINKS	16	1 through 32	Target number of links in this linkset to keep active at any given time.
ROUTE_NUMBER	None (priority for a route defaults to zero)	0 through MAX_ROUTES	Route number and optional priority associated with a destination that can be reached through this linkset. As many as 256 route numbers can be specified per linkset. The same route number can be assigned to multiple linksets. The optional priority associated with the route number is relative to other linksets that also contain this route number.
END	N/A	N/A	Marks the end of this linkset definition. This parameter is required.

6 Configuring ISUP

ISUP configuration overview

The ISUP (ISDN User Part) layer provides the interface for applications to establish, maintain, and clear circuit switched connections through the SS7 network in accordance with the following recommendations:

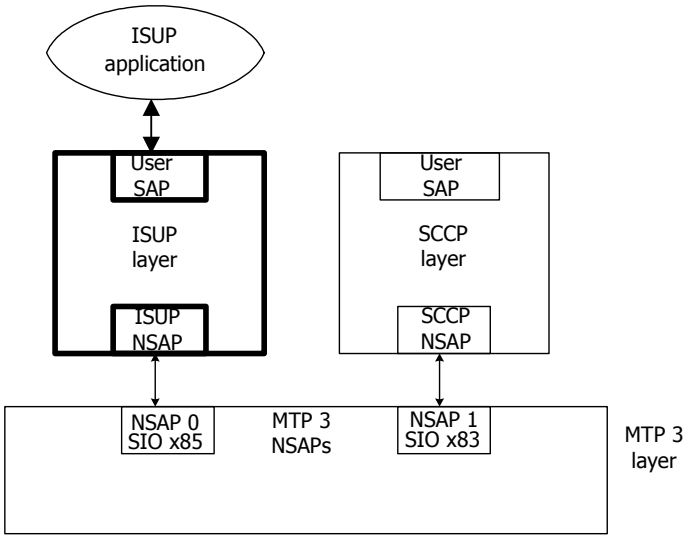
- CCITT Q.761 - Q.764 (Blue Book, White Book, and 1997)
- ANSI T1.113 (1988, 1992, and 1995)
- ETSI Version 2
- ETSI Version 3
- Q.767
- NTT Q.761 - 764

The ISUP layer is also responsible for circuit group management such as blocking, unblocking, and resetting circuits and circuit groups.

ISUP implements services through the configuration of general parameters and the following entities:

Entity	Description
Circuits	Physical bearer circuits controlled by the ISUP layer. Circuits are identified by both a circuit index and a circuit identification code (CIC). The circuit index is a number unique across all circuits configured on a particular TX board. This number has only local significance. It is used between the ISUP layer and the local call processing application to identify a particular circuit. The CIC (usually called the kick, or kick code) is used between signaling points (the ISUP layer and the far exchange that terminates the other end of the circuit) to uniquely identify a particular circuit. The CIC must be configured at both ends of the circuit to identify the exact same bearer facility (the same T1 span and timeslot). CICs need not be unique across circuits that terminate on different far exchanges. Circuits are specified in the ISUP configuration file in groups. A group is one or more circuits with contiguous circuit indexes and contiguous CICs that terminate on the same far exchange and have common characteristics. A single circuit group is frequently used to represent all the timeslots on a single T1 or E1 span. When defining a circuit group, only the circuit index and CIC of the first circuit in the group, along with the number of circuits in the group, are specified. The ISUP layer derives the circuit index and CIC for subsequent circuits since they are considered to be contiguous. The starting circuit index and starting CIC for a group need not be the same value.
User service access points (SAPs)	Define the interface between the ISUP layer and the user applications. **Note:** NMS ISUP supports only a single user application; configure only one user SAP.
Network service access points (NSAPs)	Define the interface between the ISUP layer and the MTP layer. NSAPs identify the MTP network SAP to be used by the ISUP layer, allowing multiple user parts (for example, ISUP and SCCP) to share access to the MTP layer services.

The following illustration shows the concept of user SAPs and network SAPs:



Creating the ISUP configuration

NMS SS7 provides sample files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. To learn the location of the sample configuration files, see *Sample SS7 configurations* on page 9.

The NMS ISUP configuration utility, *isupcfg,* runs as part of the initial board configuration with *ss7load. isupcfg* reads the text configuration file and downloads the specified configuration to the ISUP task on the TX board. The utility can also be run after initial configuration to dynamically update some configuration parameters. For more information on running *isupcfg* after initial download, see the *NMS ISUP Developer's Reference Manual.*

Sample ISUP configuration file

The following example is the configuration file for board 1 in the two-board ANSI sample configuration:

```
# General configuration parameters
MAX_SAPS              2
MAX_NSAPS             2
MAX_CIRCUITS          96
MAX_GROUPS            5               !max number of circuit groups
MAX_CALLREFS          96              !max number of active circuits
MAX_ROUTES            10              !max number of routes
OPC                   1.1.1           !my point code
CLLINAME              NMSsfwB2.41
END
# Service Access Point (SAP)
USER_SAP              0
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ANSI95, ITUWHITE, ITUBLUE, Q767)
MAX_LENGTH            20              !max length of a phone number
END
# Network Service Access Point (NSAP)
NSAP                  0
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ITUWHITE, ITUBLUE, Q767)
END
# Circuit Database
CIRCUIT               1               !circuit number
CIC                   1               !Circuit identification code
DPC                   1.1.2           !DPC of far exchange
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ITUWHITE, ITUBLUE, Q767)
TRUNK                 708
CIRCUIT_TYPE          BOTHWAY         !INCOMING, OUTGOING, or BOTHWAY
CONTROL_TYPE          ODD_EVEN        !ALL, NONE, or ODD_EVEN
NUM_CIRCUITS          24              !number of circuits in this group
END
#
CIRCUIT               25              !circuit number
CIC                   25              !Circuit identification code
DPC                   1.1.2           !DPC of far exchange
SWITCH_TYPE           ANSI92          !switch type (ITU, ANSI88, ANSI92,
                                       ITUWHITE, ITUBLUE, Q767)
TRUNK                 847
CIRCUIT_TYPE          BOTHWAY         !INCOMING, OUTGOING, or BOTHWAY
CONTROL_TYPE           ODD_EVEN       !ALL, NONE, or ODD_EVEN
NUM_CIRCUITS           24             !number of circuits in this group
END
#
END
```

Configuring ISUP for the Japan-NTT variant

Follow these guidelines when configuring the ISUP layer for Japan-NTT network operation:

- Set the SWITCH_TYPE attribute for all USAP, NSAP, and CIRCUIT entries to JNTT.
- Specify 16-bit point codes in either hexadecimal or ***x.y.z*** dotted notation:
  - Specify hexadecimal point codes in the order in which they are transmitted on the link; that is, the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits.
  - To specify J-NTT 16-bit point codes in ***x.y.z*** notation, add the following statement to the MTP 3 general configuration section:

    ```
    PC_FORMAT       JNTT
    ```

    This statement tells the ISUP configuration utility to treat all subsequent point codes as ***mcode.scode.ucode*** format and generate 16-bit internal point codes with the U-code in the most significant seven bits, the S-code in the next four bits, and the M-code in the least significant five bits.

Note: The Japanese TTC variant is supported with the JNTT setting and the Global Messaging Toolkit.

ISUP configuration reference

This topic presents the ISUP configuration file parameters:

- General parameters
- SAP parameters
- NSAP parameters
- Circuit group parameters

General parameters

The general parameters control the overall operation of the ISUP layer process.

Note: All ISUP timer values are in seconds.

Parameter	Default	Valid values	Description
MAX_SAPS	1	1	Maximum number of user applications.
MAX_NSAPS	1	1 through 255	Maximum number of interfaces with the MTP 3 network layer.
MAX_GROUPS	32	0 through 65535	Maximum number of circuit groups managed by the ISUP layer.
MAX_ROUTES	16	0 through 65535	Maximum number of routes.
MAX_CIRCUITS	96	0 through 65535	Maximum number of circuits to be managed by the ISUP layer.
MAX_CALLREFS	16	0 through 65535	Maximum number of call references (connections) that ISUP can keep track of simultaneously.
OPC	None	N/A	Point code of this node, specified as ***x.y.z*** (three bytes, decimal value, separated by periods), as a hexadecimal value preceded by 0x (0x123), or as a decimal value.
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Use for both Japan NTT and TTC networks. Point codes are interpreted and displayed as 16-bit ***mcode.scode.ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
CLLINAME	None	N/A	Common language location identifier (CLLI) name assigned to this node (exactly 11 ASCII characters).
T18_TIMER	12	0 through 65535	Time to wait for a response to a group blocking message that was sent.

Parameter	Default	Valid values	Description
T19_TIMER	60	0 through 65535	Time to wait for a response to an initial group blocking message that was sent.
T20_TIMER	12	0 through 65535	Time to wait for a response to a group unblocking message that was sent.
T21_TIMER	60	0 through 65535	Time to wait for a response to an initial group unblocking message that was sent.
T22_TIMER	12	0 through 65535	Time to wait for a response to a circuit group reset message that was sent.
T23_TIMER	60	0 through 65535	Time to wait for a response to an initial circuit group reset message that was sent.
T28_TIMER	10	0 through 65535	Time to wait for a CQR after sending a CQM.
TGRES_TIMER	5	0 through 65535	Group reset timer.
TFGR_TIMER	5	0 through 65535	ANSI first group received timer.
TRACE_EVENT	FALSE	TRUE FALSE	If TRUE, enables event logging.
TRACE_DATA	FALSE	TRUE FALSE	If TRUE, enables data tracing.
TRACE_WARNING	FALSE	TRUE FALSE	If TRUE, enables logging of unexpected information element value warnings.
TRACE_ERROR	FALSE	TRUE FALSE	If TRUE, enables logging of message encoding errors.
IG_PASS_ALNG	FALSE	TRUE FALSE	If TRUE, messages are sent in pass-along format.
ITU_UCICS	FALSE	TRUE FALSE	If TRUE, enables an ITU configuration to send UCIC messages. If FALSE, UCICs are not sent.
EXT_ELMTS	FALSE	TRUE FALSE	If TRUE, enables the sending and receiving of extended elements.
RAW_MSGS	FALSE	TRUE FALSE	If TRUE, enables the sending and receiving of raw messages.
ONE_GRPMSG	FALSE	TRUE FALSE	If TRUE, the stack reacts to the first CGB and GRS group message (ANSI only).
QCONGONSET1	600	0 through 65535	Queue to the host application congestion level 1 onset.

Parameter	Default	Valid values	Description
QCONGABATE1	400	0 through 65535	Queue to the host application congestion level 1 abatement threshold.
QCONGONSET2	900	0 through 65535	Queue to the host application congestion level 2 onset.
QCONGABATE2	700	0 through 65535	Queue to the host application congestion level 2 abatement threshold.
QCONGONSET3	1200	0 through 65535	Queue to the host application congestion level 3 onset.
QCONGABATE3	1000	0 through 65535	Queue to the host application congestion level 3 abatement threshold.
MCONGONSET1	20	0 through 65535	TX percentage of memory remaining congestion level 1 onset.
MCONGABATE1	25	0 through 65535	TX percentage of memory remaining congestion level 1 abatement threshold.
MCONGONSET2	10	0 through 65535	TX percentage of memory remaining congestion level 2 onset.
MCONGABATE2	15	0 through 65535	TX percentage of memory remaining congestion level 2 abatement threshold.
MCONGONSET3	5	0 through 65535	TX percentage of memory remaining congestion level 3 onset.
MCONGABATE3	8	0 through 65535	TX percentage of memory remaining congestion level 3 abatement threshold.
RMTUSRUNAVL	FALSE	TRUE FALSE	If TRUE, configures the stack to start in remote user unavailable mode.
GRPRESETEVENT	FALSE	TRUE FALSE	If TRUE, configures the stack to send up one group reset event instead of many separate circuit reset events.
SLSFROMCICS	TRUE	TRUE FALSE	If TRUE, sets the ANSI SLS value to the bottom bits of the CIC.
DSBLRMTUSRUNAVL	FALSE	TRUE FALSE	If TRUE, disables appropriate user part test procedure (for SSURN among others).
RESTARTT7	FALSE	TRUE FALSE	If TRUE, restarts T7 when an inbound INR is received (for SSURN among others).
DISABLEACL	FALSE	TRUE FALSE	If TRUE, disables automatic congestion control (for SSURN among others).

Parameter	Default	Valid values	Description
END	N/A	N/A	Marks the end of the general section. This parameter is required.

SAP parameters

The service access point (SAP) parameters define the characteristics of the ISUP layer presented to the user applications.

Note: The ISUP layer software allows for configuration of only a single ISUP user SAP. Therefore, only one application can use NMS ISUP at a time. Timer default values in parentheses are ITU values.

Parameter	Default	Valid values	Description
USER_SAP	None	0 through MAX_SAPS	SAP number
SWITCH_TYPE	ANSI92	ITU ITUWHITE ITUBLUE ITU97 ETSIV2 ETSIV3 Q767 ANSI88 ANSI92 ANSI95 JNTT	Protocol variant employed for this application. Must match one of the switch types defined in the NSAP definition section. For Japan TTC, use JNTT and the Global Messaging Toolkit.
MASK	None	N/A	Routing mask for circuit selection by ISUP. Maximum of 20 ASCII characters where a 1 indicates the digit is significant for route matching and a 0 indicates the digit is ignored for route matching. For example, 1110000000 causes ISUP to treat the first three digits of a called address as significant when route matching.
MAX_USER2USER	20	0 through 0xff	Maximum length of user-to-user information in an IAM.
T1_TIMER	12 (15)	0 through 65535	Time to wait for a response to a release message sent.
T2_TIMER	0	0 through 65535	Time to wait for a resume message after a suspend message received.
T5_TIMER	60 (300)	0 through 65535	Time to wait for a response to initial release message sent.
T6_TIMER	30	0 through 65535	Time to wait for a resume message after a suspend (network) message received.
T7_TIMER	25	0 through 65535	Time to wait for a response (for example, ACM, ANS, or CON) to the latest address message sent.
T8_TIMER	12	0 through 65535	Time to wait for a continuity message after receiving IAM requiring continuity check.
T9_TIMER	180	0 through 65535	Time to wait for answer of outgoing call after ACM message received.

Parameter	Default	Valid values	Description
T16_TIMER	12	0 through 65535	Time to wait for a response to a reset message sent.
T17_TIMER	12 (300)	0 through 65535	Time to wait for a response to initial reset message sent.
T27_TIMER	240	0 through 65535	Time to wait for a continuity check request after ensuing continuity check failure indication is received. See the TCCR_TIMER field.
T31_TIMER	0 (disabled)	0 through 65535	Time to wait before reusing call reference after a connection is cleared.
T33_TIMER	15	0 through 65535	Time to wait for a response to information request message sent.
TEX_TIMER	0 (disabled)	0 through 65535	Time to wait before sending ANSI exit message.
TCRM_TIMER	4	0 through 65535	Time to wait for a response to a circuit reservation message sent.
TCRA_TIMER	10	0 through 65535	Time to wait for an IAM message after circuit reservation acknowledgment message sent.
TCCR_TIMER	20 (240)	0 through 65535	Time to wait for CCR after the first COT indicating failure. See the T27_TIMER field.
END	N/A	N/A	Marks the end of the SAP section. This parameter is required.

NSAP parameters

The NSAP parameters define the characteristics of the ISUP interface to the MTP 3 layer:

Parameter	Default	Valid values	Description
NSAP	None	1 through 32	Name of the NSAP section for the rest of the parameters.
SWITCH_TYPE	ANSI92	ITU ITUWHITE ITUBLUE ITU97 ETSIV2 ETSIV3 Q767 ANSI88 ANSI92 ANSI95 JNTT	Protocol variant employed for this MTP interface. Must match one of the switch types defined in the MTP 3 NSAP definition section. For Japan TTC, use JNTT and the Global Messaging Toolkit.
SSF	NATIONAL	NATIONAL INTERNATIONAL 0 through 3 RESERVED SPARE	Value used in the subservice field (SSF) of the service information octet in outgoing ISUP messages on this MTP interface.
MTP_SAP	0	0 through 255	MTP service access point to which to bind ISUP. Must match one of the NSAP numbers defined in the MTP configuration file; must be unique among all user parts that use NMS MTP (SCCP, TUP).
END	N/A	N/A	Marks the end of the NSAP section. This parameter is required.

Circuit group parameters

The circuit group parameters specify the characteristics of each of the circuit groups to be managed by the ISUP layer. One entry is made for each circuit group.

Note: Timer default values in parentheses are ITU values.

Parameter	Default	Valid values	Description
CIRCUIT	None	1 through MAX_CIRCUITS	Number of the first circuit in this group. Circuits in this group are numbered from this value to (value + NUM_CIRCUITS - 1). This range must be unique for all circuits defined. This value is used by the application and the ISUP layer to identify circuits, but has no meaning to the far exchange.
CIC	1	0 through 4095	Circuit identification code (CIC) of the first circuit in this group. Circuits in this group are assigned CICs from this value to (value + NUM_CIRCUITS - 1). The number range must agree with the CICs assigned to this circuit group at the far exchange.
DPC	None	N/A	Destination point code to which this circuit group connects.

Parameter	Default	Valid values	Description
ALT_OPC	0	N/A	Originating Point code for this set of circuits. If not present, the OPC is set to OPC from the NSAP. This needs to be used carefully with the appropriate MTP configuration changes.
CIRCUIT_TYPE	INCOMING	INCOMING OUTGOING BOTHWAY	Direction of calls allowed on this circuit group.
CONTROL_TYPE	NONE	NONE ALL ODD_EVEN	Dual seizure control.
GROUP_CHARS	0	0 through 0xff	When non-zero, this value is placed in the group characteristics of the CVR message.
SWITCH_TYPE	ANSI92	ITU ITUWHITE ITUBLUE ITU97 ETSIV2 ETSIV3 Q767 ANSI88 ANSI92 ANSI95 JNTT	Protocol variant employed for this application. Must match one of the switch types defined in the NSAP definition section. For Japan TTC, use JNTT and the Global Messaging Toolkit.
SSF	0xff (NSAP)	NATIONAL INTERNATIONAL 0 through 3 RESERVED SPARE 0xff	NSAP value is the default; however, putting a value in this field overrides the default.
NUM_CIRCUITS	1	1 through 4095	Number of circuits in this circuit group.
T4_TIMER	0	0 through 65535	Time to wait for call modification complete message.
T12_TIMER	12 (15)	0 through 65535	Time to wait for response to blocking message.
T13_TIMER	60 (300)	0 through 65535	Time to wait for a response to the initial blocking message sent.
T14_TIMER	12 (15)	0 through 65535	Time to wait for a response to an unblocking message sent.
T15_TIMER	60 (300)	0 through 65535	Time to wait for a response to the initial unblocking message sent.
TVAL_TIMER	30	0 through 65535	ANSI circuit validation timer.
TPAUSE_TIMER	2	0 through 65535	Time to wait after MTP pause before resetting circuits.
END	N/A	N/A	Marks the end of this circuit group definition. This parameter is required.

7 Configuring SCCP

SCCP configuration overview

The SCCP (Signaling Connection Control Part) layer builds on the services of the MTP layer to provide SS7 applications with a higher level transport subsystem. SCCP adds the following services to those provided by the MTP layers:

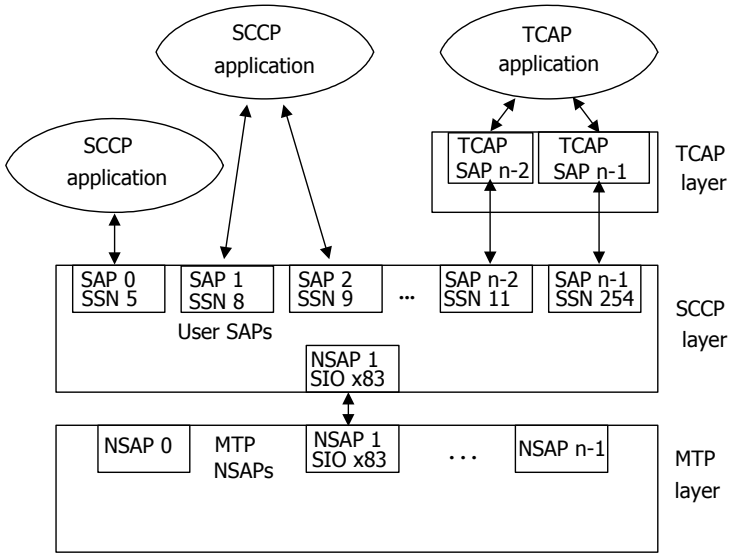
- The ability to address individual applications or databases, known as subsystems, at a signaling point through a SCCP-level address consisting of a point code and a subsystem number.
- An OSI-like connectionless transport service.
- An OSI-like connection-oriented transport service.
- An address translation mechanism called global title translation that can translate a string of digits (such as a telephone number or mobile identification number) into a point code or subsystem number, isolating applications from changes in the physical SS7 network structure.
- A subsystem management layer that tracks the status of targeted subsystems at particular signaling points, known as concerned signaling points, and can optionally associate a backup signaling point with a subsystem for high availability applications.

Applications access these services either directly from the SCCP layer or indirectly through the TCAP layer.

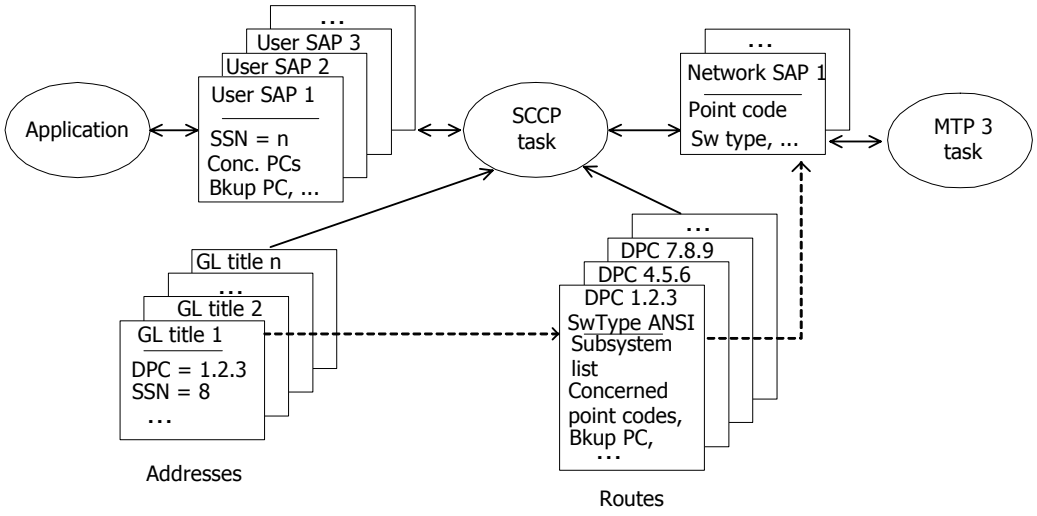
SCCP implements services through the configuration of general parameters and the following entities:

Entity	Description
User SAPs	Define the interface between the user applications and the SCCP layer. One user SAP is defined for each application using the SCCP layer services. A user SAP is associated with a single subsystem number and protocol variant (ANSI or ITU-T). The user SAP defines whether the application is replicated on another node for reliability purposes and lists any concerned point codes (nodes that must be notified of any change in the status of the application).
NSAPs	Define the interface between the SCCP layer and the MTP layer 3. One network SAP is defined for each MTP 3 layer interface that the SCCP layer uses. Typically the SCCP layer has only a single network SAP. If the same system supports multiple protocol variants (ANSI and ITU-T), the SCCP layer has a separate network SAP for each switch type.
Routes	Define one route for each destination signaling point that the SCCP layer may be used to access. The route defines the destination point code of that signaling point and each subsystem of interest at that signaling point, as well as any backup point codes that replicate those subsystems. If the SCCP default routing feature is employed, all routing is deferred to the MTP layers and no SCCP routes need to be defined. See *Using default routing* on page 103.
Address translations	Define how the SCCP layer is to translate or route between global titles, point codes, and subsystem numbers. See *Configuring global title translations* on page 106.

The following illustration shows the concept of user SAPs. When the application interfaces with the TCAP layer, the TCAP SAPs map one-for-one with an SCCP user SAP.



The following illustration shows the relationship between the SCCP configurable entities:



Creating the SCCP configuration

NMS SS7 provides sample SCCP files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. To learn the location of the sample configuration files, see *Sample SS7 configurations* on page 9.

The NMS SCCP configuration utility, *sccpcfg,* runs as part of the initial board configuration with *ss7load*. *sccpcfg* reads the text configuration file and downloads the specified configuration to the SCCP task on the TX board. The utility can also be run after initial configuration to dynamically update some configuration parameters. For more information on running *sccpcfg* after initial download, see the *NMS SCCP Developer's Reference Manual.*

Sample SCCP configuration file

The following example is the configuration file for board 1 in the two-board ANSI sample configuration:

Note: All SCCP timer values are in seconds; a timer value of zero disables that timer.

```
#
# Sample SCCP configuration file for the following configuration
#
#       General:
#       4 user APPs max
#       1 MTP3 network SAP
#       all others general defaults
#       User SAPs:
#       ANSI-92, 1.1.2 is concerned PC
#       Network Saps:
#       ANSI, point code = 1.1.1
#       Routes:
#       1 to 1.1.2, SSNs 3 & 4, 1.1.2 is concerned PC
#       Address translations:
#       8477069701 = far point code, SSN 3, 8477069700
#       847xxxxxxx = far point code, SSN 4
#
# General Configuration Section
MAX_USERS          4          # Max SCCP user applications
MAX_NSAPS          2          # Number of MTP3 interface (max 1
                              # per switch type)
MAX_SCLI           1          # Max simultaneous sequenced
                              # connectionless data xfers (Class 1 only)
MAX_ADDRS          2          # Max Address translation entries
MAX_ROUTES         10         # Max far point codes SCCP knows
DEF_ROUNTING       FALSE      # Set Default Routing (FALSE=OFF, TRUE=ON)
SAVE_CONNS         FALSE      # Drop connections on lost link
                              # (FALSE) or don't drop (TRUE).
ALARM_LEVEL        1          # Set alarm level reporting (0=off,
                              # 1=default, 2=debug, 3=detail)
TRACE_DATA         FALSE      # Set data tracing (FALSE=OFF, TRUE=ON)
MAX_ADJDPC         2          # Max far point codes directly adjacent to us
MAX_MSGDRN         5          # Max msgs to send in a batch when MTP comes
                              # up. (prevents flooding when link(s)come up)
MAX_XUDT           1          # Number of control blocks to allocate for
                              # reassembling segmented extended
                              # UnitDaTa (ITU-92 only)
MAX_XUDTXREF       2          # Max number of local references
                              # used to segment eXtended UnitDaTa
MAX_CONN           512        # Max number of simultaneous connections
CONN_THRESH        1          # Minimum number of SCCP buffers
                              # that must be available for new
                              # connection to be accepted
QUEUE_THRESH       8          # Max number of buffers that can
                              # be queued for connection waiting
```

```
                            # for conn window to open
SOG_THRESH        3         # Minimum number of SCCP buffers
                            # that must be available for SOR
                            # request from replicated (backup)
                            # subsystem to be accepted

# Note all timer values are in seconds (0 disables timer)
XREFFRZ_TIMER     2         # wait before reusing local reference
#ASMB_TIMER       0         # wait for all segments of
                            # segmented XUDT (ITU-92 only)
FREEZE_TIMER      2         # wait before reusing connection reference
CONN_TIMER        180       # wait for response to connection request
TXINACT_TIMER     600       # wait with no outgoing packets on
                            # a connection before issuing
                            # Inactivity test (IT) message
RXINACT_TIMER     900       # wait with no incoming packets on
                            # a connection before releasing
                            # connection (should be > TXINACT_TIMER)
REL_TIMER         10        # wait for response to release request
#REPREL_TIMER     0         # wait for response to 2nd release
                            # request (ITU only)
#INTERVAL_TIMER   0         # wait before reporting abnormal
                            # release (ITU only)
GUARD_TIMER       2         # wait after MTP3 traffic restart
                            # before application traffic
RESET_TIMER       30        # wait for response to Reset Request
#SCLI_TIMER       0         # max time sequenced
                            # connectionless transmission can
                            # take(class 1)
SST_TIMER         30        # time between subsystem status tests
SRT_TIMER         30        # time between subsystem routing tests

NSAP_TIMER        1         # time between bursts of messages
                            # to MTP3 when draining built-up
                            # queue (prevents congestion when
                            # link comes back up
IGNORE_TIMER      30        # delay after receiving SOG before
                            # actually going out of service
COORD_TIMER       30        # wait for grant to go out of
                            # service (SOG) after issuing SOR request
END
#
# User SAP configuration for 1st application
#
USER_SAP          0          # Sap number start at 0
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now

#Concerned point codes (Nodes to be notified of App's availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                            # digits of global title
MAX_HOPS          10         # maximum network hops
END                          # User application 0
#
# User SAP configuration for 2nd application
#
USER_SAP          1          # Application 1
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now

#Concerned point codes (Nodes to be notified of App's availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                            # digits of global title
MAX_HOPS          10         # maximum network hops
END                          # User application 1
#
# User SAP configuration for 3rd application
#
USER_SAP          2          # Application 2
```

```
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now

# Concerned point codes (Nodes to be notified of Apps availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                             # digits of global title
MAX_HOPS          10         # maximum network hops
END                          # User application 1
#
# User SAP configuration for 4th application
#
USER_SAP          3          # Application 3
SWITCH_TYPE       ANSI92     # one of ITU92, ITU88, ITU96, ANSI92, ANSI88, ANSI96
#BACKUP_PC        1.2.3      # this application not replicated for now
# Concerned point codes (Nodes to be notified of App's availability) up to 8
CONC_PC           1.1.2
ADDR_MASK         FFF0000000 # requires match on only 1st 3
                             # digits of global title
MAX_HOPS          0          # maximum network hops
END                          # User application 1
#
# Network (MTP3) Saps - one per switch type
#
NSAP              1          # SCCP must be NSAP 1 if isup present too
SWITCH_TYPE       ANSI       # one of ITU, ANSI
DPC               1.1.1      # REQUIRED - this node's point code
DPC_LEN           4          # normally wouldn't specify this -
                             # let it default based on switch type
MSG_LEN           256        # MTU length on this network
TXQ_THRESH        20         # max packets queued to this MTP3
ADDR_MASK         FFFFFFFFFF # match 10 digits for global title
                             # translation of incoming packets
MAX_HOPS          10         # maximum network hops
END                          # of ANSI MTP3 NSAP
#
# Address Translations: 8477069701
#
ADDRESS           8477069701 # global title - incoming
REPLACE_GLT       TRUE       # remove translated global title
                             # from message
SWITCH_TYPE       ANSI       # one of ITU, ANSI
NI_IND            NATIONAL   # one of NATIONAL [NAT],INTERNATIONAL [INTL]
ROUTING_IND       C_SSN      # set outgoing routing flag(PC_SSN or GLT)
DPC               1.1.2      # translated destination point code
SSN               3          # translated subsystem number
GT_FORMAT         1          # outgoing global title includes
                             # translation type, numbering
                             # plan, and encoding scheme
TRANS_TYPE        2          # translation type
NUM_PLAN          1          # ISDN numbering plan
GL_TITLE          8477069700 # outgoing global title
END                          # of address translation for 8477069701
#
# Address Translations: 847xxxxxxx
#
ADDRESS           847        # global title - incoming
REPLACE_GLT       FALSE      # include translated global title
                             # in message
SWITCH_TYPE       ANSI       # one of ITU, ANSI
NI_IND            NATIONAL   # one of NATIONAL [NAT].INTERNATIONAL [INTL]
ROUTING_IND       GLT        # set outgoing routing flag(PC_SSN or GLT)
DPC               1.1.2      # translated destination point code
SSN               4          # translated subsystem number
END                          # of address translation for 847xxxxxxx

#
# Routes: 1 for each node known to the SCCP layer
#
ROUTE            1.1.2       # destination point code
SWITCH_TYPE      ANSI        # one of ITU, ANSI
```

```
ADJACENT        TRUE         # this dest directly adjacent
TRANSLATOR      FALSE        # not a translator node
#BACKUP_PC      x.y.z        # this node not currently replicated

       #define all subsystems of interest at 1.1.1 (up to 8)
SSN             3            # first subsystem at 1.1.2
SSN_SNR         TRUE         # normal routed
SSN_ACC         TRUE         # initially accessable
#SSN_BPC        x.y.z        # this subsystem not currently replicated
       # concerned point codes - other nodes to be notified when
       # status of this SSN at this node changes - must have a
       # route for any point code listed here
#CONC_PC        q.r.s        # 1st concerned point code
#CONC_PC        q.r.t        # 2nd concerned point code
END                          # of route 1.1.2, SSN 3

SSN             4            # another subsystem at 1.1.2
SSN_SNR         TRUE         # normal routed
SSN_ACC         TRUE         # initially accessable
#SSN_BPC        x.y.z        # this subsystem not currently replicated
       #concerned point codes - other nodes to be notified when
       # status of this SSN at this node changes - must have a
       # route for any point code listed here
#CONC_PC        q.r.s        # 1st concerned point code
#CONC_PC        q.r.t        # 2nd concerned point code
END                          # of route 1.1.2, SSN 4

END                          # of route 1.1.2
```

Using default routing

The SCCP default routing feature enables routing of SCCP packets generated by local applications, either directly with SCCP or through the TCAP layer, to signaling points whose point codes and subsystem numbers are not preconfigured.

This feature is primarily intended for applications that act as databases, or servers, in an SS7 network and cannot be preconfigured with the point codes of all clients that access the server. This feature is also suitable for other SCCP or TCAP-based applications such as replicated subsystems that do not require the signaling point and subsystem management features of the SCCP management functions.

When default routing is enabled, the SCCP layer attempts to deliver messages for which it has no explicit route entry by relying solely on the MTP layer routing. Default routing applies to all classes of SCCP messages (connectionless, connection-oriented, and management). Default routing effectively disables all SCCP management functionality for those remote signaling points or subsystems without explicit routes.

When default routing is enabled, you can preconfigure routes to certain known destinations, such as adjacent STPs or translators, or other remote subsystems that are replicated and require the SCCP management procedures for routing to backup signaling points in case of outages or congestion.

This topic presents:

- Enabling default routing
- Impact of default routing on SCCP message routing
- Impact of default routing on SCCP management
- SCCP limitations when default routing is enabled

Enabling default routing

Default routing is disabled by default. To enable default routing, add the following statement to the general configuration parameters section of the SCCP configuration file:

```
DEF_ROUTING  TRUE   # Default Routing (FALSE = OFF, TRUE = ON)
```

Impact of default routing on SCCP message routing

With default routing enabled, routing of outbound messages by the SCCP layer is performed as follows:

1. Global title translation, if necessary, is performed on the outbound message.
2. The SCCP layer checks for an explicit route to the destination point code. If an explicit route exists, the status of the destination signaling point and subsystem, if known, is checked. If the destination signaling point is active and the destination subsystem available (or unknown, such as routing by global title), the message is passed to the MTP 3 layer for delivery. If the signaling point is not accessible or the subsystem is unavailable, standard routing failure treatment is applied.
3. If no explicit route exists for the destination point code and default routing is disabled, standard routing failure treatment is applied.
4. If no explicit route exists for the destination point code and default routing is enabled, the message is passed to MTP 3 for delivery. If the MTP 3 layer is unable to deliver the message for any reason, the message is discarded and no notification is given to the application that originated the message.

Impact of default routing on SCCP management

The SCCP layer does not attempt to track the status of signaling points and subsystems that are not explicitly defined with route entries. Subsystem prohibited (SSP) and subsystem allowed (SSA) messages received for signaling points with no explicit route entry are ignored. Likewise, pause, resume, and remote user unavailable indications from the MTP 3 layer regarding signaling points with no explicit route entry are ignored. In effect, signaling points/subsystems with no explicit route entry are always considered available at the SCCP layer.

Subsystem testing (SST) is applied only to explicitly configured signaling points and subsystems. SST messages are never sent to destinations with no explicit route entry defined.

If an SST message is received from a signaling point that is not explicitly configured with a route entry, the appropriate response (SSA if the local subsystem is available, no response if the local subsystem is prohibited or unequipped) is returned, provided that the MTP 3 layer can route the response to that signaling point.

If the SCCP layer receives a message from an unknown (not explicitly configured) remote signaling point for a local subsystem that is either prohibited or unequipped, a subsystem prohibited (SSP) message is returned to the originating signaling point, provided that the MTP 3 layer can route to that signaling point. The appropriate message return (connectionless) or connection refusal (connection request) procedures are also performed.

SCCP limitations when default routing is enabled

The use of default routing effectively disables the SCCP layer management functions for those signaling points not explicitly configured with route entries. Following are some limitations of default routing:

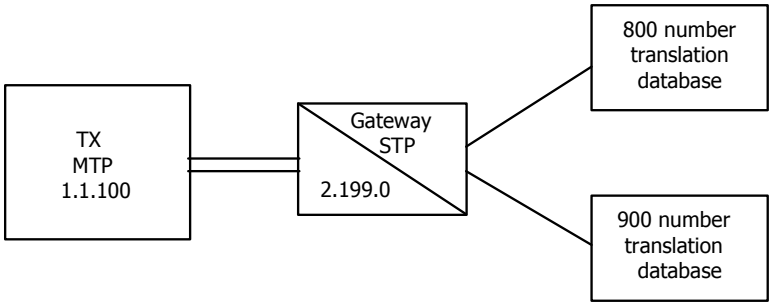
- If a local subsystem is to be replicated to take advantage of the SCCP layer's ability to route incoming messages to the backup signaling point when the local application is unavailable, an explicit route to the backup signaling point must be configured.
- If a remote subsystem is to be replicated to take advantage of the SCCP layer's ability to route outgoing messages to the backup signaling point when the primary signaling point or subsystem is unavailable, explicit routes to both the primary and backup signaling points must be configured.
- If a local application (SCCP or TCAP user) wants to receive status indications for a remote signaling point or subsystem when it becomes available, unavailable, or congested, an explicit route entry must be configured for each such remote signaling point. It must be listed as a concerned point code in the application's user SAP configuration.
- If a remote subsystem is to receive automatic SSP and SSA messages when a local application (SCCP or TCAP user) declares itself unavailable or available, an explicit route entry must be configured for each such remote signaling point. It must be listed as a concerned point code in the application's user SAP configuration.
- Subsystem prohibited (SSP) and subsystem allowed (SSA) messages received for signaling points with no explicit route entry are ignored. In effect, signaling points or subsystems with no explicit route entry are always considered available at the SCCP layer.

Configuring global title translations

The SCCP layer supports global title translation, enabling applications to address messages with a string of digits such as a telephone number or a mobile identification number. Applications can rely on the network configuration to route the message to the correct destination signaling point and subsystem. Global title translations can help isolate applications from changes in the network structure, such as when a particular network database is moved from one signaling point code to another. This feature is available for both applications directly accessing the SCCP layer and for applications indirectly using the SCCP layer through the TCAP layer.

The SCCP layer can translate a global title into its final destination address (point code and subsystem number) or into the address of a gateway signal transfer point (STP). A gateway STP is typically an STP containing a global title translation capability that acts as the entry point to a network for all requests originating from outside the network. In either case, the global title digits can be carried through in the translated address for subsequent translation by the gateway STP or analysis by the destination application.

In the following example network diagram, the SCCP application uses both the 800 number translation services and the 900 number translation services provided by the databases shown:



In this example, the node does not know the network addresses (point codes) of these databases; only the address of the gateway is configured in the SS7 configuration files.

When the application sends a request for either an 800 number or 900 number translation, it generates a SCCP request (or TCAP request) with the 10-digit 800 or 900 number to be translated as the global title digits and the routing indicator field set to route by global title. The application does not include a point code or subsystem number in the destination address.

The following SCCP sample configuration file illustrates the configuration of the address translation.

- The ADDRESS_MASK parameter for the user SAP that corresponds to this application is set to FFF0000000. This setting results in the SCCP layer choosing the first address translation entry with the first three digits matching the first three global title digits in the message address being translated.
- The configured address translation for both 800 and 900 numbers specifies the point code of the gateway STP. The gateway STP performs subsequent global title translation on the message destination address to insert the actual point code of the appropriate database. A subsystem number is also included here, although it could also be inserted by the gateway STP.

- The configured address translation for both 800 and 900 numbers specifies a routing indicator of route by global title to indicate to the gateway STP to perform global title translation. It also indicates that the original global digits are not to be replaced in the outgoing message so that the gateway STP can perform the subsequent translation.

```
#
# Sample configuration of Global Title Translation
< ... General Parameters >
# User SAP configuration for example application
USER_SAP          0           # Application 1
SWITCH_TYPE       ANSI92      # protocol variant
CONC_PC           2.199.0     # Gateway STP
ADDR_MASK         FFF0000000  # match 1st 3 global title digits
END                           # User application 0

# Address Translations: 800XXXXXXX numbers
ADDRESS           800         # global title - incoming
REPLACE_GLT       FALSE       # retain global title in message
SWITCH_TYPE       ANSI        # Address format - one of ITU, ANSI
NI_IND            NATIONAL    # national address format
DPC               2.199.0     # translated destination point code
SSN               254         # translated subsystem number
ROUTING_IND       GLT         # set outgoing routing flag to GLT
END                           # of address translation for 800xxxxxxx
# Address Translations: 900XXXXXXX numbers
ADDRESS           900         # global title - incoming
REPLACE_GLT       FALSE       # retain global title in message
SWITCH_TYPE       ANSI        # Address format - one of ITU, ANSI
NI_IND            NATIONAL    # national address format
DPC               2.199.0     # translated destination point code
SSN               254         # translated subsystem number
ROUTING_IND       GLT         # set outgoing routing flag to GLT
END                           # of address translation for 900xxxxxxx
< Route entry for gateway STP >
```

The address masks have the following properties:

- Incoming messages use the address masks defined in the network SAP section of the SCCP configuration file.
- Outgoing messages use the address masks defined in the user SAP section of the SCCP configuration file.
- Up to four address masks can be defined in each network SAP or user SAP section.
- Address masks are applied in the order they are defined in the configuration file. Therefore, list the most specific mask first and the most general mask last.

Multiple originating point codes (OPC)

The SCCP layer can be configured to support multiple OPCs to both single networks or multiple networks. The SCCP layer will receive SCCP messages, both connectionless and connection-oriented, addressed to any of the configured OPC values. SCCP subsystem management messages for each OPC are also supported.

MTP multiple OPC configuration

The MTP layer must be configured correctly for multiple OPC emulation. For more information and examples for emulating multiple OPCs to a single network and to multiple networks, refer to *Configuring multiple OPC emulation* on page 59.

Configuring multiple OPC emulation for a single network

The SCCP layer can be configured to emulate two different OPCs to a single destination.

In this example, the SCCP layer emulates OPC 0.0.2 to the DPC 0.0.1, and emulates OPC 0.0.4 to the same DPC 0.0.1. An ALT_OPC section (ALT_OPC through the END statement) must be added to the USAP section for each emulated OPC:

```
USER_SAP                0               # Sap number start at 0
SWITCH_TYPE             ITU92           # one of ITU92, ITU88, ANSI92, ANSI88
ADDR_MASK               FFF0000000      # match on only 1st 3 digits of GT
MAX_HOPS                10              # maximum network hops
INACT_CONTROL           TRUE            # app inactivity timing
# ALT_OPC section must be placed at end of USER_SAP section
ALT_OPC                 0.0.2           # Alternate Originating Point Code
CONC_PC                 0.0.1           # Concerned point code
END
ALT_OPC                 0.0.4           # Alternate Originating Point Code
CONC_PC                 0.0.1           # Concerned point code
END
END                                     # User application 0
```

An ALT_OPC field must be added to the ROUTE section for each emulated OPC:

```
ROUTE                   0.0.1           # destination point code
SWITCH_TYPE             ITU             # one of ITU, ANSI
ADJACENT                TRUE            # this dest directly adjacent
TRANSLATOR              FALSE           # not a translator node
ALT_OPC                 0.0.2
ALT_OPC                 0.0.4
  #define all subsystems of interest at 0.1.2 (up to 8)
SSN                     3               # first subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 3

SSN                     254             # another subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 254

END                                     # of route 0.1.2
```

Configuring multiple OPC emulation to multiple networks

The SCCP layer can be configured to emulate a different OPC to each of two different networks.

In this example, the SCCP layer emulates OPC 0.0.2 to the DPC 0.0.1, and emulates OPC 0.0.4 to the DPC 0.0.3. An ALT_OPC section (ALT_OPC through the END statement) must be added to the USAP section for each emulated OPC:

```
USER_SAP                0               # Sap number start at 0
SWITCH_TYPE             ITU92           # one of ITU92, ITU88, ANSI92, ANSI88
#CONC_PC                 0.0.1           # Concerned point code
ADDR_MASK               FFF0000000      # match on only 1st 3 digits of GT
MAX_HOPS                10              # maximum network hops
INACT_CONTROL           TRUE            # app inactivity timing
# ALT_OPC section must be placed at end of USER_SAP section
ALT_OPC                 0.0.2           # Alternate Originating Point Code
CONC_PC                 0.0.1           # Concerned point code
END
ALT_OPC                 0.0.4           # Alternate Originating Point Code
CONC_PC                 0.0.3           # Concerned point code
END
END                                     # User application 0
```

An ALT_OPC field must be added to each ROUTE section for each emulated OPC:

```
ROUTE                   0.0.1           # destination point code
SWITCH_TYPE             ITU             # one of ITU, ANSI
ADJACENT                TRUE            # this dest directly adjacent
TRANSLATOR              FALSE           # not a translator node
ALT_OPC                 0.0.2
  #define all subsystems of interest at 0.1.1 (up to 8)
SSN                     3               # first subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 3

SSN                     254             # another subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 254

END                                     # of route 0.1.1
#
ROUTE                   0.0.3           # destination point code
SWITCH_TYPE             ITU             # one of ITU, ANSI
ADJACENT                TRUE            # this dest directly adjacent
TRANSLATOR              FALSE           # not a translator node
ALT_OPC                 0.0.4

  #define all subsystems of interest at 0.1.1 (up to 8)
SSN                     3               # first subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 3

SSN                     254             # another subsystem
SSN_SNR                 TRUE            # normal routed
SSN_ACC                 TRUE            # initially accessable
END                                     # SSN 254

END                                     # of route 0.1.1
```

SCCP configuration reference

This topic presents the SCCP configuration file parameters:

- General parameters
- User SAP parameters
- Network SAP parameters
- Address translation parameters
- Route parameters

General parameters

The general parameters define the operational characteristics of the SCCP layer, such as upper bounds for internal data structures (these determine the amount of memory used by the SCCP layer), queue thresholds, and various protocol timer values. It is the first section of the configuration file.

Parameter	Default	Valid values	Description
MAX_USERS	2	1 through 255	Maximum number of user SAPs.
MAX_NSAPS	1	1 through 255	Maximum number of network SAPs.
MAX_SCLI	20	0 through 65535	Maximum number of simultaneous sequenced connectionless data transfers.
MAX_ADDRS	7	0 through 65535	Maximum number of address translation entries.
MAX_ROUTES	4	0 through 65535	Maximum number of route entries.
MAX_ADJDPC	4	0 through 65535	Maximum number of point codes that can be specified as adjacent (that are notified directly by this node of status changes).
MAX_MSGDRN	5	0 through 65535	Maximum number messages queued to MTP3 to send in one time interval when exiting flow control.
MAX_XUDT	0	0 through 65535	Maximum number of control blocks to allocate for reassembling segmented extended unit data. Used only for ITU-92. Should be zero for ANSI operation.
MAX_XUDTXREF	0	0 through 65535	Maximum number of local references used to segment extended unit data. Used only for ITU-92. Should be zero for ANSI operation.
MAX_CONN	512	0 through 65535	Maximum number of simultaneous connections.

Parameter	Default	Valid values	Description
DEF_ROUTING	FALSE	TRUE FALSE	If TRUE, enables default routing.
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Point codes are interpreted and displayed as 16-bit ***mcode.scode.ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
SAVE_CONNS	FALSE	TRUE FALSE	If TRUE, retains connections when destination inaccessible. If FALSE, drops connections when destination inaccessible.
ALARM_LEVEL	1	0 1 2 3	Alarm level reporting. 0 = Disable 1 = Default 2 = Debug 3 = Detail
TRACE_DATA	FALSE	TRUE FALSE	If TRUE, enables data tracing.
CONN_THRESH	3	0 through 9	Minimum percentage of board memory that must be available before accepting a new connection in either direction. Expressed in units of 10 percent (for example, 3 = 30 percent).
QUEUE_THRESH	3	0 through 32766	Maximum number of data messages that can be queued for a connection waiting for the connection window to open.
SOG_THRESH	1	0 through 9	Minimum percentage of board memory that must be available before granting a subsystem out-of-service (SOR) request from a backup signaling point. Expressed in units of 10 percent (for example, 3 = 30 percent).
SCLI_TIMER	2 seconds	0 through 65535	Maximum time that a sequenced connectionless transmission can take before control block is deallocated.
SST_TIMER	30 seconds	0 through 65000	Time to wait between subsystem status tests.
NSAP_TIMER	1 second	0 through 65535	Time to wait between draining blocks of queued messages to the MTP 3 layer after exiting flow control. Used to prevent flooding MTP 3 after network congestion abates. See MAX_MSGDRN.
SRT_TIMER	30 seconds	0 through 65535	Time to wait between subsystem routing tests (ANSI only).
IGNORE_TIMER	30 seconds	0 through 65535	Time period after local subsystem goes out of service to ignore subsystem test messages.

Parameter	Default	Valid values	Description
COORD_TIMER	30 seconds	0 through 65535	Time to wait for response to coordinated state change request.
XREFFRZ_TIMER	1 second	0 through 65535	Time to freeze an XUDT local reference before reusing it (ITU-92 only).
ASMB_TIMER	20 seconds	0 through 65535	Maximum time for reassembling all segments of an XUDT message (ITU-92 only).
FREEZE_TIMER	1 second	0 through 65535	Time to freeze a connection local reference before reusing it.
CONN_TIMER	180 seconds	0 through 65535	Time to wait for response to connection request.
TXINACT_TIMER	600 seconds	0 through 65535	Time to wait with no outgoing packets on a connection before sending an inactivity test message.
RXINACT_TIMER	900 seconds	0 through 65535	Time to wait with no incoming packets on a connection before clearing connection. Must be greater than TXINACT_TIMER.
REL_TIMER	4 seconds	0 through 65535	Time to wait for response to release request.
REPREL_TIMER	4 seconds	0 through 65535	Time to wait for response to second release request (ITU-T 92 only).
INTERVAL_TIMER	8 seconds	0 through 65535	Time to wait to report abnormal release timer.
GUARD_TIMER	1 second	0 through 65535	Time to wait after MTP 3 restart before allowing application traffic.
RESET_TIMER	6 seconds	0 through 65535	Time to wait for response to reset request.
AIC_TIMER	480 seconds	0 through 65535	Time with no application activity for an active connection before SCCP generates a connection inactivity indication event. Used only if the application inactivity control is enabled for that user SAP.
AIC_RESP_TIMER	10 seconds	0 through 65535	Time the application gets to respond to a connection inactivity indication event. Use only if the application inactivity control is enabled for that user SAP.
ACR_TIMER	10 seconds	0 through 65535	Time the application gets to respond to an incoming connection indication with either a connection response or release request before the SCCP layer refuses connection. If the value is zero, no timing for the application response is performed.

Parameter	Default	Valid values	Description
SCCP_ALARM_LEVEL	1	1 2 3	Desired level of alarms generated by SCCP layer. 1 = (Normal) Normal service impacting alarms. 2 = (Debug) All normal alarms plus all messages in or out. 3 = (Detail) All debug alarms plus detailed events.
MEM_THRESH_1	10	0 through 99	Percentage of board memory available at which memory congestion level 1 starts.
MEM_THRESH_2	8	0 through 99	Percentage of board memory available at which memory congestion level 2 starts.
MEM_THRESH_3	5	0 through 99	Percentage of board memory available at which memory congestion level 3 starts.
END	N/A	N/A	Denotes end of the section. This parameter is required.

User SAP parameters

One user service access point (SAP) is defined for each application using the NMS SCCP. A user SAP is associated with a single subsystem number and switch type (ANSI88, ANSI92, ANSI96, ITU88, ITU92, ITU96). The user SAP defines whether the application is replicated on another node for reliability purposes, and lists any concerned point codes (nodes that must be notified of any change in the availability of the application).

Parameter	Default	Valid values	Description
USER_SAP	None	0 through (MAX_USERS-1)	Marks the start of a user SAP definition.
SWITCH_TYPE	ANSI92	ITU88 ITU92 ITU96 ANSI88 ANSI92 ANSI96	Protocol variant employed on this user SAP.
BACKUP_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Point code where this subsystem is backed up.
CONC_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Concerned point code to be notified of changes in the availability of this application. As many as eight CONC_PC entries (on separate lines) are allowed per user SAP. **Note:** If OPC emulation is used, any concerned point codes must be listed in an ALT_OPC section.

Parameter	Default	Valid values	Description
ADDR_MASK	FFF...F	N/A	ASCII string describing which digits of the global title to match when performing global title translation. As many as four ADDR_MASK entries are allowed per user SAP. **Note:** Address masks are ASCII strings containing a 0 (zero) or F in each character position to determine whether the corresponding global title digit is used in the match. For example, the string 000FFFFFFF ignores the first three digits and compares only the last seven digits when searching the global title table for a match. Similarly, the string FFF compares only the first three digits to determine a match.
MAX_HOPS	10	1 through 15	Hop count value to be used on outgoing SCCP messages from this SAP.
INACT_CONTROL	False	True/1/Yes False/0/No	When True, enables SCCP inactivity timing on connections associated with this SAP, enabling SCCP to detect and clear connections of which the application has lost track. The application must handle the connection inactivity indication event and respond with a connection inactivity response if this feature is enabled.
CONG_THRESH_1	600	1 through 2000	Number of messages outstanding to a higher level task (such as TCAP) or a user application at which inbound congestion level 1 starts.
CONG_THRESH_2	900	1 through 2000	Number of messages outstanding to a higher level task (such as TCAP) or a user application at which inbound congestion level 2 starts.
CONG_THRESH_3	1200	1 through 2000	Number of messages outstanding to a higher level task (such as TCAP) or a user application at which inbound congestion level 3 starts.
ALT_OPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Denotes the start of an emulated OPC section. All emulated OPC values must be listed in their own ALT_OPC section. A maximum of eight ALT_OPC sections are allowed in a USER_SAP section.
CONC_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Concerned point code to be notified of changes in the availability of this application. As many as eight CONC_PC entries (on separate lines) are allowed in each ALT_OPC section.
END	N/A	N/A	Denotes the end of the ALT_OPC section in the current USER_SAP section.
END	N/A	N/A	Denotes end of the section. This parameter is required.

Network SAP parameters

The network service access point (SAP) defines the point at which the SCCP layer accesses the network (MTP 3) layer. One network SAP is defined for each supported switch type (ANSI or ITU-T). The NSAP number assigned in this section (NSAP ***number*** statement) must match a valid NSAP number defined in the NSAP section (NSAP ***number*** statement) of the MTP 3 configuration file.

Note: If both the SCCP and ISUP layers are used on the same board, the SCCP layer cannot be assigned to MTP3 NSAP 0 (zero); ISUP always uses this NSAP.

Parameter	Default	Valid values	Description
NSAP	None	0 through (MAX_NSAPS - 1)	Marks start of a network SAP definition. Must match an NSAP number defined in the MTP 3 configuration.
SWITCH_TYPE	ANSI	ITU ANSI	Protocol variant employed on this NSAP.
SSF	NATL (ANSI) INTL (ITU)	INTERNATIONAL|INTL SPARE NATIONAL|NATL RESERVED|RES	Value to be used in the subservice field for this network.
DPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Point code of this node on this network interface. If OPC emulation is in use, the default OPC should be listed here. This parameter is required.
DPC_LEN	24 (ANSI | ITU) 14 (ITU)	14 24	Point code length employed on this network.
ALT_OPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	List of additional emulated OPC values.
MSG_LEN	256	32 through 1500	Maximum length of a message passed to MTP 3 on this SAP.
TXQ_THRESH	20	0 through 32766	Maximum number of messages to queue to MTP 3 when flow control is on before discarding.
ADDR_MASK	FFF...F	N/A	ASCII string describing which digits of the global title to match when performing global title translation. Up to four ADDR_MASK entries are allowed per network SAP. **Note:** The network SAP address mask is used only when providing global translation for incoming messages (those received from the network). For messages originated by an application on this node, the user SAP address mask is used.
MAX_HOPS	10	1 through 15	Hop count value to be used when returning undeliverable incoming messages back to the source of the message.

Parameter	Default	Valid values	Description
SCCP_NI_IND	0 (ITU) 1 (ANSI)	0 1	National or international indicator in the called or calling party address parameter of the outgoing SCCP management messages.
END	N/A	N/A	Denotes the end of the section. This parameter is required.

Address translation parameters

Address entries define how the SCCP layer translates global titles. A global title can translate into one of the following:

- A point code and subsystem number (use GT_FORMAT 0).
- Another global title only (in this case the message to be routed must include a destination point code in addition to the incoming global title).
- Another global title and point code.
- Another global title and subsystem number (in this case the message to be routed must include a destination point code in addition to the incoming global title).
- Another global title and point code and subsystem number.

Multiple address translations can be configured, up to the MAX_ADDRS value specified in the general parameters section.

Parameter	Default	Valid values	Description
ADDRESS	None	N/A	Incoming global title string, ASCII digits (for example, 0 through 9).
REPLACE_GLT	FALSE	TRUE FALSE	If TRUE, replace the translated global title in the outgoing message. If FALSE, copy the incoming global title, translated point code, and subsystem to the outgoing message.
SWITCH_TYPE	ANSI	ITU ANSI	Format of this address.
NI_IND	NAT	NATIONAL|NAT INTERNATIONAL|INTL	National or international indicator.
ROUTING_IND	PC_SSN	PC_SSN GLT	Routing indicator for the translated address. PC_SSN = Route by PC and SSN GLT = Route by global title
SSN	None	0 through 255	Translated subsystem number (required for GT_FORMAT 0).
DPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	Translated destination point code (required for GT_FORMAT 0).

Parameter	Default	Valid values	Description
GT_FORMAT	0	0 1 2 3 4	Structure of the outgoing global title. Use only when REPLACE_GLT parameter is TRUE. 0 = No global title translation. 1 = (ANSI) Outgoing global title includes translation type, numbering plan, and encoding scheme. (ITU) Outgoing global title includes nature of address indicator. 2 = (ANSI and ITU) Outgoing global title includes translation type only. 3 = (ITU only) Outgoing global title includes translation type, numbering plan, and encoding scheme. 4 = (ITU only) Outgoing global title includes translation type, numbering plan, encoding scheme, and nature of address indicator.
GL_TITLE	None	N/A	Outgoing global title string (ASCII digits; such as 0 through 9). Use only when REPLACE_GLT parameter is TRUE.
TRANS_TYPE	0	0 through 255	Outgoing global title translation type. Use only when REPLACE_GLT parameter is TRUE.
NAT_ADDR	3	0 through 4	Outgoing global title nature of address indicator (ITU only). Use only when REPLACE_GLT parameter is TRUE.
NUM_PLAN	1	0 through 15	Outgoing global title numbering plan (ISDN numbering plan). Use only when REPLACE_GLT parameter is TRUE.
END	N/A	N/A	Denotes the end of the section. This parameter is required.

Route parameters

A route configuration entry defines a point code (and its subsystems) known to this node. Define a route entry for each point code and switch type to which this node can send SCCP messages.

Note: A route definition contains one or more subsystem definitions, each of which spans multiple lines and is terminated with an END statement. Each route definition as a whole is also terminated with an END statement. Mismatched END statements are a common cause of configuration errors and can cause unpredictable results.

Parameter	Default	Valid values	Description
ROUTE	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Destination point code. This parameter is required.
SWITCH_TYPE	ANSI	ITU ANSI	Protocol variant for this point code.
TRANSLATOR	TRUE	TRUE FALSE	If TRUE, this signaling point is a translator node.

Parameter	Default	Valid values	Description
ADJACENT	TRUE	TRUE FALSE	If TRUE, this signaling point is adjacent for SCCP point code and subsystem management procedures.
BACKUP_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Backup point code. If not present, signaling point is not replicated.
ALT_OPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101)	List of any emulated OPC values for this route. This field is not required if OPC emulation is not in use.
SSN	None	0 through 255	Subsystem number. Also denotes the beginning of the subsystem definition subsection that is terminated by the END statement. As many as eight subsystem definition subsections can be included in each route definition.
SSN_SNR	TRUE	TRUE FALSE	Subsystem routing. TRUE = Normal routed FALSE = Backup routed
SSN_ACC	TRUE	TRUE FALSE	Subsystem accessibility. TRUE = Initially accessible FALSE = Not initially accessible
SSN_BPC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Subsystem backup point code. If not present, the subsystem is not replicated.
SSN_UP_ON_RESUME	1	1 0	1 = Subsystem is immediately put back in service when a point code resume message is received from MTP. The subsystem test procedure is not started. 0 = Disables this functionality.
CONC_PC	None	Use dotted notation (such as 2.45.76) or a hexadecimal number (such as 0x101).	Concerned point code to be notified of changes in the availability of this subsystem. As many as eight CONC_PC entries (on separate lines) are allowed per subsystem per route.
END	N/A	N/A	Required parameter denoting the end of the current subsystem definition subsection. Repeated for each separate SSN section within this route entry.
END	N/A	N/A	Required parameter denoting the end of the current route definition section.

8 Configuring TCAP

TCAP configuration overview

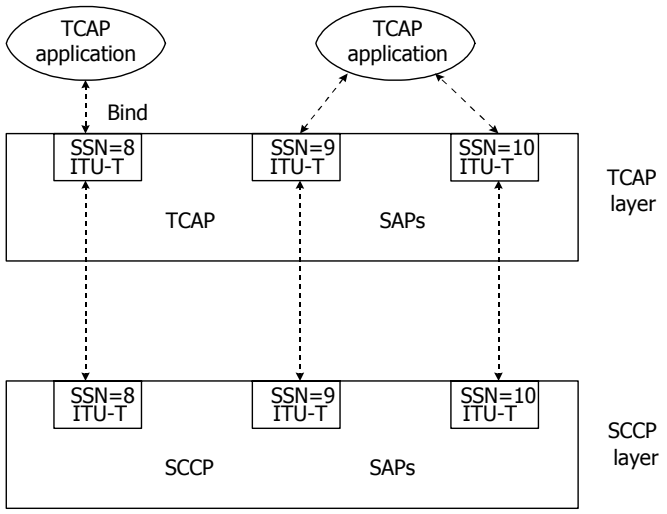
The TCAP (Transaction Capabilities Application Part) layer adds transaction services onto the connectionless data transfer service provided by SCCP. Transactions in the SS7 network are typically database queries and responses or requests to activate services in remote switching points.

TCAP can be configured for either ANSI (see ANSI T1.114) or ITU-T (see Q.771 - Q.775) operation, on a per-application basis. Use of ITU-T TCAP on top of an ANSI MTP/SCCP stack is fully supported. TCAP requires using SCCP and MTP.

TCAP implements services through the configuration of the following entities:

Entity	Description
General configuration parameters	Define the resource allocation for the TCAP layer: maximum number of user SAPs, simultaneous dialogs, and outstanding invokes.
User service access points (SAPs)	Define the interface between a TCAP user application and the TCAP layer. One user SAP is defined for each application using the TCAP layer services. A user SAP is associated with a single subsystem number and protocol variant (ANSI-88, ANSI-92, ANSI-96, ITU-88, ITU-92, or ITU-97). Each TCAP user SAP maps directly to a SCCP user SAP in the SCCP configuration file (see *SCCP configuration overview* on page 97), although not all SCCP SAPs must be assigned to TCAP applications. Some applications can access the SCCP layer directly.

The following illustration shows the relationship between TCAP user SAPs and SCCP user SAPs:



Creating the TCAP configuration

NMS SS7 provides sample TCAP files for ANSI standalone and redundant configurations and ITU standalone and redundant configurations that you can modify for your specifications. To learn the location of the sample configuration files, see *Sample SS7 configurations* on page 9.

The NMS TCAP configuration utility, *tcapcfg,* runs as part of the initial board configuration with *ss7load. tcapcfg* reads the text configuration file and downloads the specified configuration to the TCAP task on the TX board. *tcapcfg* can also be run after initial configuration to dynamically update some configuration parameters. For more information on running *tcapcfg* after initial download, see the *NMS TCAP Developer's Reference Manual.*

Sample TCAP configuration file

Note: Most configurable parameters default to reasonable values if not specified.

```
#
# Sample TCAP configuration file for the following configuration
#
#       General:
#           4 user APPs max
#           200 max simultaneous dialogs
#           200 max simultaneous invokes
#           all others general defaults
# General Configuration Section
TCAP_ALARM_LEVEL      1       # standard alarms
MAX_TCAP_USERS        4       # Max TCAP user applications
MAX_TCAP_DIALOGS      200     # Max TCAP simultaneous dialogs
MAX_TCAP_INVOKES      200     # Max TCAP simultaneous invokes
END
#
# User SAP configuration for 1st application
#
USER_SAP              0       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
#
# User SAP configuration for 2nd application
#
USER_SAP              1       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
#
# User SAP configuration for 3rd application
#
USER_SAP              2       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
#
# User SAP configuration for 4th application
#
USER_SAP              3       # Sap number start at 0
SWITCH_TYPE           ANSI92  # one of ITU88, ITU92, ITU97, ANSI88, ANSI92, ANSI96
END                           # User application 0
```

TCAP configuration reference

This topic presents the TCAP configuration file parameters:

- General parameters
- User SAP parameters

General parameters

The general parameters define the upper bounds for internal data structures, which determine the amount of memory used by the TCAP layer:

Parameter	Default	Valid values	Description
MAX_TCAP_USERS	4	1 through 512	Maximum number of user SAPs.
MAX_TCAP_DIALOGS	256	1 through 32767	Maximum number of TCAP transactions that can be pending at any one time.
MAX_TCAP_INVOKES	256	1 through 32767	Maximum number of TCAP invoke operations that can be pending at any one time.
MIN_TID_LEN	1	1 through 4	Forces use of transaction IDs of at least the specified number of bytes when using ITU-T TCAP. Primarily for interoperability with certain networks that require use of 4-byte transaction IDs.
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Point codes are interpreted and displayed as 16-bit values in ***mcode***.***scode***.***ucode*** format where ***ucode*** occupies the most significant 7 bits, ***scode*** occupies the next 4 bits, and ***mcode*** occupies the least significant 5 bits.
TCAP_ALARM_LEVEL	1	0 1 2 3	Level of alarms to be generated by the TCAP layer. 0 = None (not recommended) 1 = Service impacting events 2 = Individual transaction impacting events (encode/decode errors) 3 = Debugging level
TCAP_TRACE_DATA	0	0 1	Enables tracing of TCAP packets to the *ss7trace* utility. 0 = Tracing disabled 1 = Tracing enabled
TCMEM_THRESH_1	20	1 through 99	Percentage of memory available in default message buffer pool below which congestion level 1 is triggered.
TCMEM_THRESH_2	15	1 through 99	Percentage of memory available in default message buffer pool below which congestion level 2 is triggered. Must be less than TCMEM_THRESH_1.

Parameter	Default	Valid values	Description
TCMEM_THRESH_3	10	1 through 99	Percentage of memory available in default message buffer pool below which congestion level 1 is triggered. Must be less than TCMEM_THRESH_2.
END	N/A	N/A	Marks the end of this section. This parameter is required.

User SAP parameters

Define one user SAP for each application or subsystem using the TCAP layer services. A user SAP is associated with a single subsystem number and switch type (ANSI88, ANSI92, ANSI96, ITU88, ITU92, ITU97).

Parameter	Default	Valid values	Description
ALLOW_INVOKE_END	0	0 1	When set to 1, allows an invoke component in an ITU-T end message.
ALT_PARAM_LEN	0	0 1	When set to 0, uses the normal method of deriving a component parameter length from the component length field. When set to 1, uses an alternate method of obtaining the parameter length from the Set or Sequence tag and length. Used only for ANSI TCAP protocols.
DEFAULT_CHECKPOINT	CHKPT_NONE	CHKPT_NONE CHKPT_SEND CHKPT_ALL	CHKPT_NONE = No transactions are checkpointed. CHKPT_SEND = Only transactions initiated by the TX board are checkpointed. CHKPT_ALL = All transactions are checkpointed to the backup TCAP task.
INACTIVITY_TIMER	0	0 through 64535	Default inactivity timer. Number of seconds before an inactivity indication is sent for a transaction with no traffic. If set to zero, the inactivity timer is disabled.
SCCP_ADDR_OVERRIDE	0	0 1	SCCP called and calling addresses specified by a user application are ignored for the following messages: • ITU-T: continue, end, and user abort • ANSI: conversation, response, and user abort When set to 1, SCCP called and calling addresses specified by the user application are used for all affected messages.
SCCP_SAP	Same value as TCAP SAP ID	0 through 32766	SCCP SAP ID (from SCCP configuration file) to map this TCAP SAP to.

Parameter	Default	Valid values	Description
SWITCH_TYPE	ANSI92	ITU88 ITU92 ITU97 ANSI88 ANSI92 ANSI96	Protocol variant used on this SAP.
TCAP_T1	60	1 through 32767	Default invocation timer, in seconds (time to wait for response to invoke).
TCAP_T2	60	1 through 32767	Time to wait for reject of a non-invoke component, in seconds, before considering operation successful (where applicable).
TCAP_SEQ_TIMER	60	1 through 255	Duration to request SCCP to maintain SLS when sequential delivery required.
TCQ_THRESH_1	600	1 through 65535	Number of inbound messages queued to the application before entering level 1 congestion.
TCQ_THRESH_2	900	1 through 65535	Number of inbound messages queued to the application before entering level 2 congestion. Must be greater than TCQ_THRESH_1.
TCQ_THRESH_3	1200	1 through 65535	Number of inbound messages queued to the application before entering level 2 congestion. Must be greater than TCQ_THRESH_2.
USER_SAP	None	0 through MAX_USERS - 1	Marks start of a user SAP definition.
END	N/A	N/A	Marks the end of this section. This parameter is required.

9 Configuring TUP

TUP configuration overview

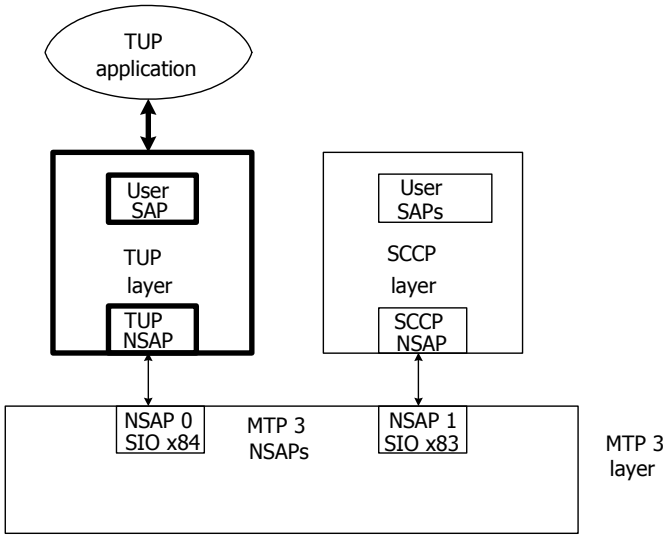
Like the ISUP layer, the TUP (Telephone User Part) layer provides an interface for applications to establish, maintain, and clear circuit switched connections with the SS7 network. The TUP layer is also responsible for circuit group management, such as blocking, unblocking, and resetting of circuits and circuit groups.

The TUP layer operates in accordance with the CCITT (ITU-T) recommendations Q.721 - Q.724 and China GF001 - 9001 *(Technical Specifications of SS7 for the National Telephone Network of China).* TUP is not used in ANSI networks, so there is no applicable ANSI standard for TUP.

TUP implements services through the configuration of general parameters and the following entities:

Entity	Description
Circuits and circuit groups	Physical bearer circuits controlled by the TUP layer. Like the ISUP layer, circuits are identified by both a circuit index and a circuit identification code (CIC). The circuit index is a number unique across all circuits configured on a particular TX board. This number has only local significance. It is used between the TUP layer and the local call processing application to identify a particular circuit. The CIC (the kick or kick code) is used between signaling points (the SS7 TUP layer and the far exchange that terminates the other end of the circuit) to uniquely identify a particular circuit. The CIC must be configured at both ends of the circuit to identify the exact same bearer facility, for example, the same T1 span and timeslot. CICs need not be unique across circuits that terminate on different far exchanges. Circuits are specified in the TUP configuration file in groups. A group is one or more circuits with contiguous circuit indexes and contiguous CICs that terminate on the same far exchange and have common characteristics. A single circuit group is frequently used to represent all the timeslots on a single T1 or E1 span, for example. When defining a circuit group, only the circuit index and CIC of the first circuit in the group, along with the number of circuits in the group, are specified. The TUP layer derives the circuit index and CIC for subsequent circuits since they are considered to be contiguous. The starting circuit index and starting CIC for a group need not be the same value.
User SAPs	Define the interface between the TUP layer and the user applications. NMS TUP supports only a single user application. Configure only one user SAP.
NSAPs	Define the interface between the TUP layer and the MTP layer. NSAPs identify the MTP network SAP to be used by the TUP layer, allowing multiple user parts (TUP, ISUP, and SCCP) to share access to the MTP layer services.

The following illustration shows the concept of user SAPs and NSAPs:



Creating the TUP configuration

NMS SS7 provides sample TUP files for both ITU-T and China configurations that you can modify for your specifications. To learn the location of the sample configuration files, see *Sample SS7 configurations* on page 9.

The NMS TUP configuration utility, *tupcfg,* runs as part of the initial board configuration with *ss7load. tupcfg* reads the text configuration file and downloads the specified configuration to the TUP task on the TX board. *tupcfg* can also be run after initial configuration to dynamically update some configuration parameters. For more information on running *tupcfg* after initial download, see the *NMS TUP Developer's Reference Manual.*

Sample TUP configuration file

The following example configures board 1 for ITU-T:

```
#  TUP Configuration File
# General configuration parameters
MAX_SAPS              1
MAX_NSAPS             2
MAX_CIRCUITS          2048
MAX_GROUPS            16      !max number of circuit groups
MAX_DPCS              16      !max number of dest. point codes
MAX_ROUTES            10      !max number of routes
ALARM_LEVEL           2       !alarm level
TRACE_EVENT           NO      !turning on=YES/off=NO event tracing
TRACE_DATA            NO      !turning on=YES/off=NO data tracing
TIMER_TRACE           NO      !turning on=YES/off=NO timer tracing
CHECKPOINT_TYPE       YES     !enable checkpointing from primary to backup
                              !this parameter is not required in
                              !standalone mode
MTPPAUSE_TIMER        2       !MTP3 Pause timer started when pause is
                              !received from MTP3. On expiration, all of
                              !the configured circuits are cleaned up.
                              !If it is set to zero, then this timer is
                              !disabled.
END
# Service Access Point (SAP)
USER_SAP              0
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
QCONGONSET1           64      !user queue congestion onset level 1
QCONGABATE1           32      !user queue congestion abatement level 1
QCONGONSET2           96      !user queue congestion onset level 2
QCONGONSET2           64      !user queue congestion abatement level 2
QCONGONSET3           128     !user queue congestion onset level 3
QCONGONSET3           96      !user queue congestion abatement level 3
END
# Network Service Access Point (NSAP)
NSAP                  0       !Network layer SAP Id
MTPSAP                0       !MTP layer SAP Id
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
OPC                   0x01    !my point code
SSF                   SSF_NAT !sub-service field value to use
END
#
# Circuit Database
CIRCUIT               1       !circuit number
CIC                   0       !circuit identification code
DPC                   0x02    !DPC of serving far exchange
NUM_CIRCUITS          200     !number of circuits in this group
GROUP_ID              1
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
END
#
# Circuit Group 2
CIRCUIT               201     !circuit number
CIC                   200     !circuit identification code
DPC                   0x02    !DPC of serving stp
NUM_CIRCUITS          200     !number of circuits in this group
GROUP_ID              2
SWITCH_TYPE           ITU-T   !switch type (ITU-T, CHINA)
END
#
# Circuit Group 3
CIRCUIT               513     !circuit number
CIC                   513     !circuit identification code
DPC                   2       !DPC of serving stp
NUM_CIRCUITS          255     !number of circuits in this group
GROUP_ID              3
END
#
END                           # End TUP configuration
```

TUP configuration reference

This topic presents the TUP configuration file parameters:

- General parameters
- User SAP parameters
- Network SAP parameters
- Circuit and circuit group parameters

General parameters

The general parameters control the overall operation of the TUP layer process.

Parameter	Default	Valid values	Description
MAX_SAPS	1	1	Maximum number of user applications.
MAX_NSAPS	1	1	Maximum number of interfaces with the MTP 3 network layer.
MAX_CIRCUITS	96	0 through 65535	Maximum number of circuits to be managed by the TUP layer.
MAX_GROUPS	32	0 through 65535	Maximum number of circuit groups managed by the TUP layer.
MAX_DPCS	16	1 through 256	Maximum number of destination point codes configured.
ALARM_LEVEL	1	1 through 4	Number of alarms. Set this number closer to 1 to limit the alarms received to the more critical alarms.
TRACE_EVENT	NO	YES NO	YES = Enable event tracing NO = Disable event tracing
TRACE_DATA	NO	YES NO	YES = Enable data tracing NO = Disable data tracing
TIMER_TRACE	NO	YES NO	YES = Enable timer tracing NO = Disable timer tracing
CHECKPOINT_TYPE	YES	YES NO	YES = Enable checkpointing from primary to backup in redundancy mode. NO = Disable checkpointing. Not required in standalone mode.
MTPPAUSE_TIMER	2	0 through 65535	Maximum duration of an MTP3 pause timer before clearing the circuits associated with a DPC. The MTP3 pause timer starts when a pause is received from MTP3. When the pause timer expires, all the configured circuits associated with the DPC for which the pause is received are cleaned up. Setting the timer value to 0 disables this functionality.

Parameter	Default	Valid values	Description
PC_FORMAT	DEFAULT	DFLT INTL JNTT	Point code format. DFLT = Point codes are interpreted and displayed as 24-bit 8.8.8 values. INTL = Point codes are interpreted and displayed as 14-bit 3.8.3 values. JNTT = Point codes are interpreted and displayed as 16-bit ***mcode***.***scode***.***ucode*** values with the U-code in the most significant 7 bits, the S-code in the next 4 bits, and the M-code in the least significant 5 bits.
T20 _TIMER	5	0 through 65535	Time to wait to send the second confirming group reset signal.
T21_TIMER	15	0 through 65535	Time to wait for a response to a circuit group reset signal. Use 4 through 15 seconds.
T22_ TIMER	60	0 through 65535	Time to wait to send another group reset signal.
T23_TIMER	5	0 through 65535	Time to wait to send the second confirming maintenance group block signal.
T24_TIMER	5	0 through 65535	Time to wait to send the second confirming maintenance group unblock signal.
T25_ TIMER	300	0 through 65535	Time to wait to alert the maintenance group unblock signal.
T26_TIMER	15	0 through 65535	Time to wait for a response to a maintenance group block signal. Use 4 through 15 seconds.
T27_TIMER	60	0 through 65535	Time to wait to send another maintenance group block signal.
T28_TIMER	15	0 through 65535	Time to wait for a response to a maintenance group unblock signal. Use 4 through 15 seconds.
T29_TIMER	60	0 through 65535	Time to wait to send another maintenance group unblock signal.
T30_TIMER	5	0 through 65535	Time to wait to send the second confirming hardware failure group block signal.
T31_TIMER	5	0 through 65535	Time to wait to send the second confirming hardware failure group unblock signal.
T32_TIMER	15	0 through 65535	Time to wait for a response to a hardware failure group block signal. Use 4 through 15 seconds.

Parameter	Default	Valid values	Description
T33_TIMER	60	0 through 65535	Time to wait to send another hardware failure group block signal.
T34_TIMER	15	0 through 65535	Time to wait for a response to a hardware failure group unblock signal. Use 4 through 15 seconds.
T35_TIMER	60	0 through 65535	Time to wait to send another hardware failure group unblock signal.
T36_TIMER	5	0 through 65535	Time to wait to send the second confirming software group block signal.
T37_TIMER	5	0 through 65535	Time to wait to send the second confirming software group unblock signal.
T38_TIMER	15	0 through 65535	Time to wait for a response to a software group block signal. Use 4 through 15 seconds.
T39_TIMER	60	0 through 65535	Time to wait to send another software group block signal.
T40_TIMER	15	0 through 65535	Time to wait for a response to a software group unblock signal. Use 4 through 15 seconds.
T41_TIMER	60	0 through 65535	Time to wait to send another software group unblock signal.
END	N/A	N/A	Marks the end of the general section. This parameter is required.

User SAP parameters

The SAP parameters define the characteristics of the TUP layer presented to the user applications. NMS TUP allows for configuration of only a single TUP user SAP. Only one application can use NMS TUP at a time.

Parameter	Default	Valid values	Description
USER_SAP	None	0 through MAX_SAPS	SAP number.
SWITCH_TYPE	ITU-T	ITU-T CHINA	Protocol variant employed for this application. Must match one of the switch types defined in the NSAP definition section.
QCONGONSET1	32	32	User queue congestion onset level 1.
QCONGABATE1	16	16	User queue congestion abatement level 1.
QCONGONSET2	64	64	User queue congestion onset level 2.
QCONGABATE2	48	48	User queue congestion abatement level 2.
QCONGONSET3	96	96	User queue congestion onset level 3.
QCONGABATE3	80	80	User queue congestion abatement level 3.
END	N/A	N/A	Marks the end of the SAP section. This parameter is required.

Network SAP parameters

The NSAP parameters define the characteristics of the TUP interface to the MTP 3 layer. NMS TUP allows for configuration of only a single NSAP. Only one switch type can be handled at a time.

Parameter	Default	Valid values	Description
NSAP	None	N/A	NSAP ID.
SWITCH_TYPE	ITU-T	ITU-T CHINA	Switch type (version of the SS7 protocol employed for this MTP 3 interface).
OPC	None	N/A	Point code of this node, specified as ***x.y.z*** (three bytes, decimal value, separated by periods) or as a hexadecimal number (for example, 0***xnnnnn***).
SSF	SSF_NAT	SSF_INTL SSF_SPARE SSF_NAT SSF_RES	Subservice field of the SIO in the outgoing TUP packets.
MTPSAP	0	0 through MAX_NSAPS	MTP SAP with which to bind.
END	N/A	N/A	Marks the end of the NSAP section. This parameter is required.

Circuit and circuit group parameters

The circuit set parameters specify the characteristics of each of the circuit sets to be managed by the TUP layer, including the circuit identification codes (CICs) and destination point code (DPC) at the other end of the circuits. One entry is made for each circuit set. Any set can be designated as a predefined group by adding a group number to this definition. A predefined group can more easily be reset, blocked, and unblocked with the TUP functions or by the network.

Parameter	Default	Valid values	Description
CIRCUIT	None	1 through 65535	Number of the first circuit in this set. Circuits in this set are numbered from this number to (this number + NUM_CIRCUITS - 1). This range must be unique for all circuits defined. This number is used by the application and the TUP layer to identify circuits, but has no meaning to the far exchange.
CIC	0	0 through 4095	Circuit identification code (CIC) of the first circuit in this set. Circuits in this set are assigned CICs from this number to (this number + NUM_CIRCUITS - 1). This number range must agree with the CICs assigned to this circuit set at the far exchange.
DPC	None	N/A	Destination point code to which this circuit set connects. Use dotted notation, such as 2.45.76, or a hexadecimal number, such as 0x101.
ALT_OPC	None	N/A	Originating point code for this set of circuits. If not present, the OPC is set to OPC from the NSAP. Use this carefully with the appropriate MTP configuration changes and specified as *x.y.z* (three bytes, decimal value, separated by periods) or as a hexadecimal number (for example, 0xnnnnn).
GROUP_ID	0	0 through 65535	Group ID number to assign to this group of circuits. 0 designates these circuits as not being a group.
NSAP_ID	0	0 through MAX_NSAPS	NSAP to use for these circuits. This value must match an NSAP ID in the NSAP definition area.
SWITCH_TYPE	ITU-T	ITU-T CHINA	Protocol variant employed for this MTP 3 interface.
NUM_CIRCUITS	1	1 through 255	Number of circuits in this circuit set.
T1_TIMER	15	0 through 65535	Time to wait for a continuity or continuity failure signal. Use 10 through 15 seconds.
T2_TIMER	30	0 through 65535	Time to wait for an address complete signal. Use 20 through 30 seconds.
T3_TIMER	15	0 through 65535	Time to wait for a clear forward signal after sending an unsuccessful signal. Use 4 through 15 seconds.
T4_TIMER	15	0 through 65535	Time to wait for a clear forward signal after sending a call failure signal. Use 4 through 15 seconds.
T5_TIMER	60	0 through 65535	Time to stop sending call failure signals.
T6_TIMER	15	0 through 65535	Time to wait for a release guard signal. Use 4 through 15 seconds.

Parameter	Default	Valid values	Description
T7_TIMER	60	0 through 65535	Time to stop sending clear forward signals.
T8_TIMER	2	0 through 65535	Time to wait for a backward check-tone. Do not exceed 2 seconds.
T9_TIMER	5	0 through 65535	Time to delay a start first-time continuity recheck. Use 1 through 10 seconds.
T10_TIMER	180	0 through 65535	Time to delay for multiple retests of continuity. Use 60 through 180 seconds.
T11_TIMER	60	0 through 65535	Time to wait to alert maintenance following initiation of a blocking signal.
T12_TIMER	15	0 through 65535	Time to wait for a response to a blocking signal. Use 4 through 15 seconds.
T13_TIMER	60	0 through 65535	Time to wait to alert maintenance that a response to the initial blocking signal was not received.
T14_TIMER	60	0 through 65535	Time to wait to repeat a blocking signal.
T15_TIMER	15	0 through 65535	Time to wait for a response to an unblocking signal. Use 4 through 15 seconds.
T16_TIMER	60	0 through 65535	Time to wait to alert maintenance that a response to the initial unblocking signal was not received.
T17_TIMER	60	0 through 65535	Time to wait to repeat an unblocking response.
T18_TIMER	15	0 through 65535	Time to wait for a response to a reset-circuit signal. Use 4 through 15 seconds.
T19_TIMER	60	0 through 65535	Time to wait to send another reset circuit signal.
END	N/A	N/A	Marks the end of this circuit group definition. This parameter is required.

10 Downloading the configurations

Starting txalarm

Use the *txalarm* utility as the primary tool to monitor what is happening on the links as you download configurations to the board and bring the links up. *txalarm* captures messages from the boards, displays them on the screen, and optionally saves them to a file.

Run *txalarm* from a separate window according to the following syntax:

```
txalarm [-f filename]
```

where ***filename*** specifies the file to which alarms are copied.

Downloading to the boards

After modifying the configuration files and starting *txalarm*, download the configurations to the TX boards using *ss7load*. *ss7load* is located in the following directories:

- Windows: *\nms\tx\bin\ss7load.bat*
- UNIX: */opt/nmstx/bin/ss7load*

This topic presents:

- Using *ss7load*
- Sample *ss7load* for Windows
- Sample *ss7load* for UNIX

Using ss7load

ss7load contains commands to download and configure all the SS7 layers, but only the MTP layer is activated. To enable the optional SS7 layers, edit *ss7load* to remove the comment symbols from the desired layers. You can also modify the script to change the file names, the path names, or both as you modify the sample configuration files to meet your system needs.

Note: Superuser permissions are required to edit *ss7load* on UNIX systems.

Run *ss7load* according to the following syntax:

```
ss7load board number
```

where ***board number*** specifies the board to which you are downloading configurations. The following example shows the output of *ss7load.* User input is shown in **bold** type:

```
prompt> ss7load 1
CPMODEL V2.0: Copyright 1998-2004, NMS Communications
Board #1 is a TX 4000
TX FLASH Interface Utility V3.0
Copyright 1997-2004, NMS Communications
TX Sys manager Protocol Version : 2
CP number 1 booted
Loading: mtp         Version B.3.0 01/14/98
mtp2cfg: sample MTP2 configuration application version B.1.0 Jan 14 1998
mtp3cfg: sample MTP3 configuration application version B.3.0 Jan 14 1998
prompt> ss7load 2
```

The following *txalarm* messages display when *ss7load* is executed for board 1. An equivalent set of messages displays for board 2 when it is downloaded.

```
<12/05/2003 15:51:58> mtp 1   1 Registering MTP Layer 2
<12/05/2003 15:51:58> mtp 1   1 Registering MTP Layer 3
<12/05/2003 15:51:58> mtp 1   1 Configuring MTP Layer 1
<12/05/2003 15:51:58> mtp 1   1 MTP1 Initializing.
<12/05/2003 15:51:58> mtp 1   1 MTP1 General Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 0: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 1: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 2: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuring link 3: TDM, External
<12/05/2003 15:51:58> mtp 1   1 MTP1 Configuration Done
<12/05/2003 15:51:58> mtp 1   1 Configuring MTP Layer 2
<12/05/2003 15:51:58> mtp 1   1 MTP2: General Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 0 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 1 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 2 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP2: Link 3 Configuration
<12/05/2003 15:51:58> mtp 1   1 MTP3: Ready...
```

ss7load performs the following tasks:

1. Executes a utility to determine the model number of the board so that it can download the correct TX-based software.

   The *txflash* utility is used to reset the boards. If the version of the kernel image on the TX board's flash memory does not match the version installed on the host system, *txflash* automatically updates the board's flash image before resetting the board.

2. Downloads the appropriate communications processor tasks using the *cplot* utility.
    - For TX 3220/C boards, downloads the *mvip.lot* and *t1e1mgr.lot* tasks to the board. These manager tasks enable use of the MVIP switching and T1/E1 configuration and control functions. If your system does not use these functions, you can remove these commands from *ss7load*. For TX 4000/C boards, these tasks are part of the on-board operating system.
    - Downloads the SS7 MTP layer task (*mtp.lot* for TX 3220/C boards, *mtp.elf* for TX 4000/C boards). This task must be downloaded before any of the other SS7 software layers. This is the only required SS7 module.
3. Downloads any optional SS7 layers that were manually enabled.
4. Executes the *mtp2cfg* (optional) and *mtp3cfg* (required) utilities to download the MTP configuration to the MTP task. The MTP layers must be configured before any of the other SS7 layers are configured.
5. Executes any optional SS7 configuration utilities that are enabled to download the respective configurations to the appropriate SS7 layer task. The order of these tasks as originally listed in the *ss7load* file must be maintained.

Sample ss7load for Windows

```
@echo off
REM ************************************************************************
REM              TX Series COMMUNICATIONS PROCESSOR BOOT FILE
REM
REM  Execute this file to perform the following:
REM     - Reset the TX board
REM     - Synchronize the on-board flash image with the installed software
REM     - Download TDM configuration
REM     - Download all TX-based tasks
REM     - Configure SS7
REM ************************************************************************
REM ************************************************************************
REM  Choose redundant or standalone mode
REM
set TXMODE=standalone
REM set TXMODE=redundant
REM ************************************************************************
REM  Choose ansi or itu for configuration files
REM
set TXCONFIG=\nms\tx\config\%TXMODE%\ansi
REM set TXCONFIG=\nms\tx\config\%TXMODE%\itu
REM ************************************************************************
REM  Define all other script parameters
REM
set TXUTIL=\nms\tx\bin
set TXCP=\nms\tx\cp
REM ************************************************************************
REM  Process arguments - Get the board number
REM
set BRD=1
if not "%1"=="" set BRD=%1
REM ************************************************************************
REM  Clear driver statistics
REM
%TXUTIL%\txstats -b %BRD% -z -q
REM ************************************************************************
REM  Get the model number (TX board type)
REM
%TXUTIL%\cpmodel -b %BRD%
```

```
if errorlevel 4000 goto boot4000
if errorlevel 3220 goto boot3220
echo ERROR! TX board number %BRD% not available.
goto end
REM ************************************************************************
REM  Perform board type-specific boot for TX 3220 or TX 3220C
REM
:boot3220
set TASKTYPE=lot
REM  Reset TX board (and verify TX flash image in sync with installed software)
%TXUTIL%\txflash -s %TXCP%\cpk3220.bin -b %BRD%
if errorlevel 1 goto failedreset

REM load the diagnostic operator console task
%TXUTIL%\cplot -c %BRD% -f %TXCP%\diag3220.lot        -n diag     -p 2  -a

REM load TDM configuration
%TXUTIL%\cplot -c %BRD% -f %TXCONFIG%\TDMcp%BRD%.bin -g tdm

REM load ARP and INF (alarm forwarding task)
%TXUTIL%\cplot -c %BRD% -f %TXCP%\arp.lot             -n arp      -p 17 -a
%TXUTIL%\cplot -c %BRD% -f %TXCP%\inf.lot             -n inf      -p 16 -a

REM load the MVIP and T1/E1 manager tasks to enable use either
REM of the MVIP and T1/E1 host APIs; NOTE: if you do not
REM use either of these APIs, remove the following 2 lines.
%TXUTIL%\cplot -c %BRD% -f %TXCP%\mvip.lot            -n mvip     -p 4  -a
%TXUTIL%\cplot -c %BRD% -f %TXCP%\t1e1mgr.lot         -n t1e1mgr  -p 15 -a

REM To enable packet tracing in the ISUP or TUP layer, make the following
REM command active to download the ETP trace collector on the board.
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\etp.lot             -n etp      -p 14 -a

goto loadcommon
REM ************************************************************************
REM  Perform board type-specific boot for TX 4000 or TX 4000C
REM
:boot4000
set TASKTYPE=elf
REM  Reset TX board (and verify TX flash image in sync with installed software)
%TXUTIL%\txflash -s %TXCP%\cpk4000.fls -b %BRD%
if errorlevel 1 goto failedreset

REM load TDM configuration
%TXUTIL%\txconfig -b %BRD% -f %TXCONFIG%\txcfg%BRD%.txt

goto loadcommon
REM ************************************************************************
REM  Load all TX-based tasks that are common to all board types
REM
:loadcommon

REM To use txdbg,
REM you should uncomment the following line to load the debug task
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\debug.%TASKTYPE%    -n debug    -p 11 -a

REM Load TXMON
REM
REM ****** IMPORTANT NOTE: *******
REM For convenience we are loading TXMON only in redundant mode.  This is
REM convenient because MTP will detect the lack of TXMON and will auto-
REM matically enter standalone mode and attempt to bring up links, without
REM application intervention.  NOTE HOWEVER, TXMON can be used as a health
REM monitor for a single board application in standalone mode.  In this case
REM the MTP will remain in a Starting state until an application (eg. RMG),
REM using the HMI API, specifically sets the mode to Standalone. In other
REM words links will not automatically try to align if TXMON is loaded.
REM
if "%TXMODE%"=="standalone" goto notxmon
%TXUTIL%\cplot -c %BRD% -f %TXCP%\txmon.%TASKTYPE%    -n txmon    -p 19 -a
:notxmon
```

```
REM Load MTP task
REM
%TXUTIL%\cplot -c %BRD% -f %TXCP%\mtp.%TASKTYPE%      -n mtp      -p 20 -a -s 12000

REM Enable the following downloads for SS7 layers you do use
REM
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\sccp.%TASKTYPE%     -n sccp     -p 21  -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\isup.%TASKTYPE%     -n isup     -p 21  -a -s 40960
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\tup.%TASKTYPE%      -n tup      -p 22  -a -s 40960
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\tcap.%TASKTYPE%     -n tcap     -p 23  -a

REM ISUP only: Enable the download of the ISUP database required for your configuration.
REM
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\itublue.%TASKTYPE%  -n itublue  -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\ituwhite.%TASKTYPE% -n ituwhite -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\q767.%TASKTYPE%     -n q767     -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\ansi88.%TASKTYPE%   -n ansi88   -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\ansi92.%TASKTYPE%   -n ansi92   -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\ansi95.%TASKTYPE%   -n ansi95   -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\itu97.%TASKTYPE%    -n itu97    -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\etsiv2.%TASKTYPE%   -n etsiv2   -p 15 -a
REM %TXUTIL%\cplot -c %BRD% -f %TXCP%\etsiv3.%TASKTYPE%   -n etsiv3   -p 15 -a
REM ************************************************************************
REM  Configure SS7 MTP2, MTP3, ISUP, TUP, TCAP & SCCP
REM  (enable these commands for any SS7 layers you do use)
REM
REM NOTE: MTP level 2 configurability is now available.
REM       However, level 2 configuration is not strictly necessary.
REM       The defaults will work for most installations.
REM
%TXUTIL%\mtp2cfg -b %BRD% -f %TXCONFIG%\MTP3cp%BRD%.cfg
%TXUTIL%\mtp3cfg -b %BRD% -f %TXCONFIG%\MTP3cp%BRD%.cfg
if "%TXMODE%"=="standalone" goto stdalncfg
REM
REM  Load redundant configuration files - note that both boards in redundant
REM  pair use the same configuration file
REM
REM %TXUTIL%\sccpcfg -b %BRD% -f %TXCONFIG%\SCCP.cfg
REM %TXUTIL%\isupcfg -b %BRD% -f %TXCONFIG%\ISUP.cfg
REM %TXUTIL%\tupcfg  -b %BRD% -f %TXCONFIG%\TUP.cfg
REM %TXUTIL%\tcapcfg -b %BRD% -f %TXCONFIG%\TCAP.cfg
goto end
:stdalncfg
REM
REM  Load standalone configuration files - note that each board in a standalone
REM  configuration gets a configuration file unique to that board
REM
REM %TXUTIL%\sccpcfg -b %BRD% -f %TXCONFIG%\SCCPcp%BRD%.cfg
REM %TXUTIL%\isupcfg -b %BRD% -f %TXCONFIG%\ISUPcp%BRD%.cfg
REM %TXUTIL%\tupcfg  -b %BRD% -f %TXCONFIG%\TUPcp%BRD%.cfg
REM %TXUTIL%\tcapcfg -b %BRD% -f %TXCONFIG%\TCAPcp%BRD%.cfg
goto end
REM ************************************************************************
REM  Report reset error
REM
:failedreset
echo ERROR! Unable to reset TX board number %BRD%.
goto end
REM ************************************************************************
REM  Exit load script
:end
set TXMODE=
set TXUTIL=
set TXCP=
set TXCONFIG=
set BRD=
set TASKTYPE=
```

Sample ss7load for UNIX

```
#!/bin/ksh
#*****************************************************************************
#             TX Series COMMUNICATIONS PROCESSOR BOOT FILE
#
#  Execute this file to perform the following:
#     - Reset the TX board
#     - Synchronize the on-board flash image with the installed software
#     - Download TDM configuration
#     - Download all TX-based tasks
#     - Configure SS7
#*****************************************************************************
#*****************************************************************************
#  Set mode (if not already determined)
#
if [ -z "$TXMODE" ]
then
TXMODE=standalone
fi
#*****************************************************************************
#  Set configuration (if not already determined)
#
if [ -z "$TXCONFIG" ]
then
TXCONFIG=/opt/nmstx/etc/$TXMODE/ansi
fi
#*****************************************************************************
#  Define all other script parameters
#
if [ -z "$TXUTIL" ]
then
TXUTIL=/opt/nmstx/bin
fi
if [ -z "$TXBASE" ]
then
TXBASE=/opt/nmstx/cp
fi
#*****************************************************************************
#  Process arguments - Get the board number
#
case $# in
0)
        BRD=1
        ;;
1)
        BRD=$1
        ;;
*)
        echo "Usage: ss7load <board#>"
        exit 1
esac
#*****************************************************************************
#  Clear driver statistics
#
$TXUTIL/txstats -b $BRD -z -q
#*****************************************************************************
#  Get the model number (TX board type)
#
BOARDTYPE=`$TXUTIL/cpmodel -b$BRD | tail -1 | cut -d' ' -f5`
case $BOARDTYPE in
TX 4000)
        FLASH="cpk4000.fls"
        ;;
TX 3220)
        FLASH="cpk3220.bin"
        ;;
*)
        echo "ERROR! Board number $BRD not available"
        exit 1
```

```
        ;;
esac
#*****************************************************************************
#  Reset TX board (and verify TX flash image in sync with installed software)
#
$TXUTIL/txflash -s $TXBASE/$FLASH -b$BRD
#*****************************************************************************
#  Perform TX board type-specific load
#
if [ $BOARDTYPE = "TX 3220" ]
then
#       Perform board type-specific boot for TX 3220 or TX 3220C
TASKTYPE=lot

#       load the diagnostic operator console task
$TXUTIL/cplot -c $BRD -f $TXBASE/diag3220.lot -n diag     -p 2 -a

#       load TDM configuration
$TXUTIL/cplot -c $BRD -f $TXCONFIG/TDMcp${BRD}.bin -g tdm

#       load ARP and INF (alarm forwarding task)
$TXUTIL/cplot -c $BRD -f $TXBASE/arp.lot      -n arp      -p 17 -a
$TXUTIL/cplot -c $BRD -f $TXBASE/inf.lot      -n inf      -p 16 -a

#       load the MVIP and T1/E1 manager tasks to enable use
#       of the MVIP and T1/E1 host APIs. Note: if you do not
#       use either of these APIs, remove the following two lines
$TXUTIL/cplot -c $BRD -f $TXBASE/mvip.lot     -n mvip     -p 4  -a
$TXUTIL/cplot -c $BRD -f $TXBASE/t1e1mgr.lot  -n t1e1mgr  -p 15 -a

#       To enable packet tracing in the ISUP or TUP layer, make the following
#       command active to download the ETP trace collector on the board.
#       $TXUTIL/cplot -c $BRD -f $TXBASE/etp.lot      -n etp      -p 14 -a
else
#       Perform board type-specific boot for TX 4000 or TX 4000C
TASKTYPE=elf

#       load TDM configuration
$TXUTIL/txconfig -b $BRD -f $TXCONFIG/txcfg$BRD.txt
fi
#*****************************************************************************
#  Load all TX-based tasks that are common to all board types
#
# To use txdbg,
# you should uncomment the following line to load the debug task
#$TXUTIL/cplot -c $BRD -f $TXBASE/debug.$TASKTYPE     -n debug    -p 11 -a

# Load TXMON
#
# ***** IMPORTANT NOTE *****
# For convenience we are loading TXMON only in redundant mode. This is
# convenient because MTP will detect the lack of TXMON and will automatically
# enter standalone mode and attempt to bring up the links, without
# application intervention. NOTE HOWEVER, TXMON can be used as a health
# monitor for a single board application in standalone mode. In this case
# the MTP will remain in a Starting state until an application (ie. RMG),
# using the HMI API, specifically sets the mode to Standalone. In other
# words links will not automatically try to align if TXMON is loaded.
#
if [ $TXMODE = "redundant" ]
then
$TXUTIL/cplot -c $BRD -f $TXBASE/txmon.$TASKTYPE   -n txmon    -p 19 -a
fi
# Load MTP task
#
$TXUTIL/cplot -c $BRD -f $TXBASE/mtp.$TASKTYPE        -n mtp      -p 20 -a -s 12000
# Enable the following downloads for SS7 layers you do use
#
#$TXUTIL/cplot -c $BRD -f $TXBASE/sccp.$TASKTYPE      -n sccp     -p 21 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/isup.$TASKTYPE      -n isup     -p 21 -a -s 40960
#$TXUTIL/cplot -c $BRD -f $TXBASE/tup.$TASKTYPE       -n tup      -p 22 -a -s 40960
```

```
#$TXUTIL/cplot -c $BRD -f $TXBASE/tcap.$TASKTYPE      -n tcap     -p 23 -a

# ISUP only: Enable the download of the ISUP database
#            required for your configuration.
#
#$TXUTIL/cplot -c $BRD -f $TXBASE/itublue.$TASKTYPE   -n itublue  -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ituwhite.$TASKTYPE  -n ituwhite -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/q767.$TASKTYPE      -n q767     -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ansi88.$TASKTYPE    -n ansi88   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ansi92.$TASKTYPE    -n ansi92   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/ansi95.$TASKTYPE    -n ansi95   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/itu97.$TASKTYPE     -n itu97    -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/etsiv2.$TASKTYPE    -n etsiv2   -p 15 -a
#$TXUTIL/cplot -c $BRD -f $TXBASE/etsiv3.$TASKTYPE    -n etsiv3   -p 15 -a
#*****************************************************************************
#  Configure SS7 MTP2, MTP3, ISUP, TUP, TCAP & SCCP
#  (enable these commands for any SS7 layers you do use)
#
#  NOTE: MTP level 2 configurability is now available.
#        However, level 2 configuration is not strictly necessary.
#        The defaults will work for most installations.
#
if [ $TXMODE = "redundant" ]
then
#
# Load redundant configuration files - note that both boards in redundant
# pair use the same configuration file
#
$TXUTIL/mtp2cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
$TXUTIL/mtp3cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
#      $TXUTIL/sccpcfg -b $BRD -f $TXCONFIG/SCCP.cfg
#      $TXUTIL/tcapcfg -b $BRD -f $TXCONFIG/TCAP.cfg
#      $TXUTIL/isupcfg -b $BRD -f $TXCONFIG/ISUP.cfg
#      $TXUTIL/tupcfg  -b $BRD -f $TXCONFIG/TUP.cfg
else
#
# Load standalone configuration files - note that each board in a standalone
# configuration gets a configuration file unique to that board
#
$TXUTIL/mtp2cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
$TXUTIL/mtp3cfg -b $BRD -f $TXCONFIG/MTP3cp${BRD}.cfg
#      $TXUTIL/sccpcfg -b $BRD -f $TXCONFIG/SCCPcp${BRD}.cfg
#      $TXUTIL/tcapcfg -b $BRD -f $TXCONFIG/TCAPcp${BRD}.cfg
#      $TXUTIL/isupcfg -b $BRD -f $TXCONFIG/ISUPcp${BRD}.cfg
#      $TXUTIL/tupcfg  -b $BRD -f $TXCONFIG/TUPcp${BRD}.cfg
fi
#*****************************************************************************
#  Exit load script
exit 0
```

Monitoring link status

After the configuration files are downloaded to the boards, the links are aligned (brought up through layer 2). When MTP layer 2 achieves link alignment, MTP layer 3 brings the links into service through an exchange of signaling link test messages (SLTMs) with its peer MTP 3 on the other board. When this signaling link test successfully completes, each board generates a message indicating that the link is up (in service). The following example shows a typical *txalarm* message sequence for successful link startup:

```
<01/09/2004 09:54:21> mtp  1  1 Flushing Buffers (OPC=0)
<01/09/2004 09:54:21> mtp  1  1 Starting Alignment
<01/09/2004 09:54:21> mtp  1  1 IAC Rx SIO
<01/09/2004 09:54:21> mtp  1  1 IAC Rx SIO
<01/09/2004 09:54:21> mtp  1  1 Rx SIE (9)
<01/09/2004 09:54:22> mtp  1  1 ALIGN TIMER 4 EXPIRED (Link Aligned)
<01/09/2004 09:54:22> mtp  1  1 Setting link 0 ACTIVE in SigLinkAvail
<01/09/2004 09:54:22> mtp  1  1 DPC 0.1.2 is now ACCESSABLE (LinkSet 1)
<01/09/2004 09:54:22> mtp  1  1 Setting link 0 ACTIVE in TrafLinkAvail
<01/09/2004 09:54:22> mtp  1  1 Setting link 0 ACTIVE from SLTA
<01/09/2004 09:54:22> mtp  1  1 8179 MTP3 Link 0 Up
<01/09/2004 09:54:21> mtp  2  1 Flushing Buffers (OPC=0)
<01/09/2004 09:54:21> mtp  2  1 Starting Alignment
<01/09/2004 09:54:21> mtp  2  1 IAC Rx SIO
<01/09/2004 09:54:21> mtp  2  1 IAC Rx SIO
<01/09/2004 09:54:21> mtp  2  1 Rx SIE (9)
<01/09/2004 09:54:22> mtp  2  1 ALIGN TIMER 4 EXPIRED (Link Aligned)
<01/09/2004 09:54:22> mtp  2  1 Setting link 0 ACTIVE in SigLinkAvail
<01/09/2004 09:54:22> mtp  2  1 DPC 0.1.2 is now ACCESSABLE (LinkSet 1)
<01/09/2004 09:54:22> mtp  2  1 Setting link 0 ACTIVE in TrafLinkAvail
<01/09/2004 09:54:22> mtp  2  1 Setting link 0 ACTIVE from SLTA
<01/09/2004 09:54:22> mtp  2  1 8179 MTP3 Link 0 Up
```

Troubleshooting link problems

If a link does not come into service shortly after downloading the configuration files to the board, determine the cause of the problem from the *txalarm* messages. Physical connection problems are the primary cause of link initialization failures, and are usually indicated by a repeated sequence of alarms, as shown in the following example:

```
<01/09/2004 09:49:58> mtp  2  1 Starting Alignment
<01/09/2004 09:49:58> mtp  2  1 Layer 1: AERM Threshold Reached
<01/09/2004 09:49:58> mtp  2  1 Alignment Aborting
<01/09/2004 09:50:10> mtp  2  1 ALIGN TIMER 2 EXPIRED, QLen=0 iacSt=8
<01/09/2004 09:50:10> mtp  2  1 LinkFailure : Alignment Not Possible
<01/09/2004 09:50:10> mtp  2  1 Flushing Buffers (OPC=0)
<01/09/2004 09:50:11> mtp  2  1 8180 MTP3 Link 0 Down
```

Some of the causes of physical link connection problems are:

- Missing or loose cable connections between the T1/E1 ports.
- Missing bus cable when one board is deriving clocking from the H.100/H.110 bus.
- Incorrect clocking configuration between the two boards (for example, both boards driving H.100/H.110 bus clocks, neither driving H.100/H.110 bus clocks, clocking not synchronized to T1/E1 port).
- Mismatched channel timeslot assignments between the two boards.
- Missing or loose cable connections between the boards and V.35 pods or between the two V.35 pods.
- Incorrect V.35 DCE/DTE configuration (for example, both boards configured as DTE (the default), DCE side of link plugged into V.35 pod strapped for DTE operation or vice versa).

The link can also align successfully at layer 2 but fail the signaling link test at layer 3, resulting in this type of alarm:

```
<01/09/2004 09:54:21> mtp  1  1 Starting Alignment
<01/09/2004 09:54:21> mtp  1  1 IAC Rx SIO
<01/09/2004 09:54:21> mtp  1  1 IAC Rx SIO
<01/09/2004 09:54:21> mtp  1  1 Rx SIE (9)
<01/09/2004 09:54:22> mtp  1  1 ALIGN TIMER 4 EXPIRED (Link Aligned)
<01/09/2004 09:54:22> mtp  1  1 8180 MTP3 Link 0 Down
```

This type of failure is almost always caused by one of the following configuration errors:

- Point codes assigned to each of the boards in the MTP 3 configuration file do not properly refer to each other.
- Link select code assigned to the link in the MTP 3 configuration file (LINK_SLC) of one board does not exactly match the link select code assigned to the same link in the MTP 3 configuration file of the second board.

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